Transport Pro™ Patient Monitor

Service Manual

Software Version 2

2024579-018 Revision A

GE Medical Systems
Information Technologies

gemedical.com

NOTE: Due to continuing product innovation, specifications in this manual are subject to change without notice. The information in this manual only supports Transport Pro software version 2 and product code AAD. It does not apply to earlier software versions.

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1 Introduction

Manual Information

Manual Purpose

This manual supplies technical information for service representatives and technical personnel so they can maintain the equipment to the assembly level. Use it as a guide for maintenance and electrical repairs considered field repairable. Where necessary, the manual identifies additional sources of relevant information and technical assistance.

See the operator's manual for the instructions necessary to operate the equipment safely in accordance with its function and intended use.

Intended Audience

This manual is intended for service representatives and technical personnel who maintain, troubleshoot, or repair this monitor.

Manual Conventions

Term	Definition
monitor	One patient monitor and one acquisition device.
display	LCD (Liquid Crystal Display) of the monitor.
acquisition device	TRAM (TRansport Acquisition Module).
network	Unity Network.

Revision History

Each page of this manual has a revision letter located at the bottom of the page. It identifies the revision level of the entire manual.

Revision	Comments
A	Release of Transport Pro version 2.

Ordering Manuals

To order additional copies of this manual, call Accessories and Supplies and request part number 2024579-018. Refer to the How To Reach Us page for Accessories and Supplies contact information.

Safety Message Definitions

The terms danger, warning, and caution are used throughout this manual to point out hazards and to designate a degree or level or seriousness. Familiarize yourself with their definitions and significance.

Hazard is defined as a source of potential injury to a person.

DANGER
Indicates an imminent hazard which, if not avoided, will result in death or serious injury.

WARNING
Indicates a potential hazard or unsafe practice which, if not avoided, could result in death or serious injury.

CAUTION
Indicates a potential hazard or unsafe practice which, if not avoided, could result in minor personal injury or product/property damage.

NOTE
Provides application tips or other useful information to assure that you get the most from your equipment.

2 Equipment Overview

General

Safety Information

Manufacturer's Responsibility

GE is responsible for the effects of safety, reliability, and performance only if:

- Assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorized by GE.
- The electrical installation of the relevant room complies with the requirements of the appropriate regulations.
- The equipment is used in accordance with the instructions for use.

Classification Information

EN

This device is intended for use under the direct supervision of a licensed health care practitioner.

This device is not intended for home use.

Federal law restricts this device to be sold by or on the order of a physician.

Contact GE for information before connecting any devices to the equipment that are not recommended in this manual.

Parts and accessories used must meet the requirements of the applicable EN 60601 series safety standards, and/or the system configuration must meet the requirements of the EN 60601-1-1 medical electrical systems standard.

Periodically, and whenever the integrity of the device is in doubt, test all functions.

The use of ACCESSORY equipment not complying with the equivalent safety requirements of this equipment may lead to a reduced level of safety of the resulting system. Consideration relating to the choice shall include:

- use of the accessory in the PATIENT VICINITY; and
- evidence that the safety certification of the ACCESSORY has been performed in accordance to the appropriate EN 60601-1 and/or EN 60601-1-1 harmonized national standard.

If the installation of the equipment, in the USA, will use 240 V rather than 120 V, the source must be a center-tapped, 240 V, single-phase circuit.

Underwriter's Laboratories, Inc.

Medical Equipment
With respect to electric shock, fire and mechanical hazards only in accordance with UL 60601-1, and CAN/CSA C22.2 NO. 601. and EN 60601-1.

Equipment Symbols

ATTENTION: Consult accompanying documents before using the equipment.

Power

NBP Go/Stop

Zero All

Silence Alarm

Battery

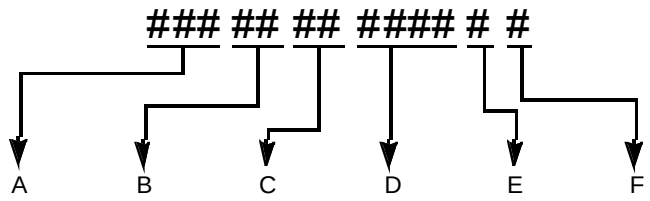
DC power

Ethernet

Video In

Equipment Identification

Every GE device has a unique serial number for identification. A sample of the information found on a serial number label is shown below.



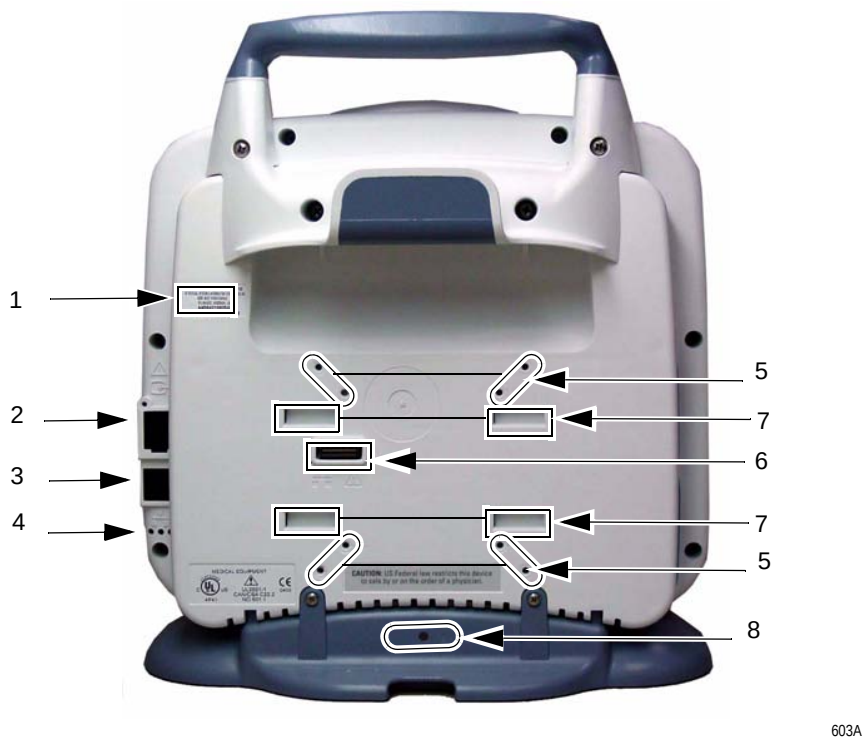
	Description
A	Product code (AAD)
B	Year manufactured
C	Fiscal week manufactured
D	Production sequence number
E	Manufacturing site
F	Miscellaneous characteristic

Views

Front

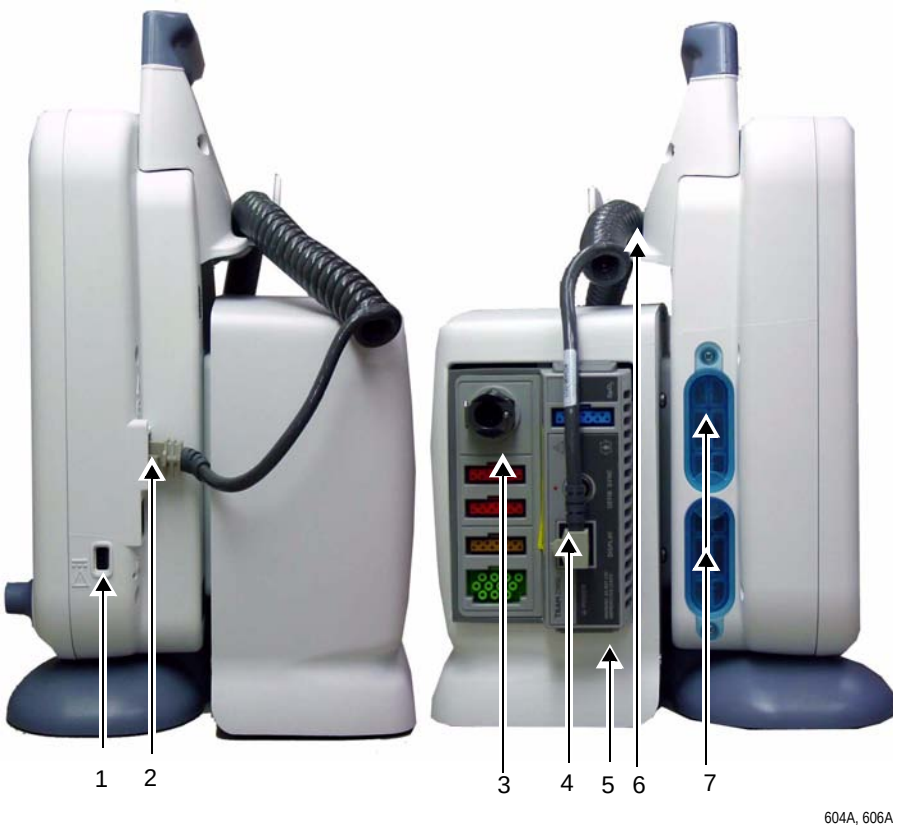
	Description
1	Alarm light
2	Controls and indicators

Rear



	Description
1	Serial number label
2	Video In (TRAM) connector
3	Ethernet (Service) connector
4	Main processor diagnostic LEDs (Light Emitting Diodes)
5	Mounting points
6	ePort connector
7	TRAM chute mounting slots
8	TRAM chute/monitor mounting slot

Side



	Description
1	DC power connector
2	Video In connector
3	TRAM module
4	TRAM communication cable
5	TRAM chute
6	Cable management tray
7	Battery doors

Controls

TRIM KNOB Control

The **TRIM KNOB** control is a 24-position rotary control with a push selection switch.

Power Key

NOTE
This key must be depressed for 0.25 seconds before the function is activated. This helps prevent inadvertently turning the monitor off.

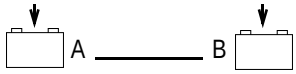
- When the monitor is battery powered, this key turns the power on and off.
- When the monitor is plugged into an electrical outlet using the optional power supply, this key turns the monitoring standby mode on and off.
- When the standby mode is turned on, patient monitoring is discontinued. However, patient data already accumulated is retained and the battery charging function continues.

Function Keys

Three fixed function keys are provided for **NBP Go/Stop, Zero All**, and **Silence Alarm**. See the operator's manual for more information.

Indicators

Power and battery indicators are located on the control panel.

Indicator	Label
DC power	
Battery power	
Battery charge status	

NOTE
All control panel indicators illuminate as the monitor powers up or during changes between normal and standby mode.

DC Power

Color	Description
Green	The monitor is connected to an electrical outlet.
None	The monitor is not connected to an electrical outlet.

Battery Power

Color	Description
Yellow	■ The monitor is powered by an internal battery. ■ The monitor is powered by a TRAM-RAC housing.
None	The monitor is powered by the external power supply.

Battery Charge Status

There are two battery change status indicators; the left indicator displays the status of battery A, the right indicator displays the status of battery B.

Color	Description
Green	The respective internal battery is fully charged.
Yellow	The respective internal battery is being charged. If both batteries are present and require charging, then both indicators illuminate, even though they charge sequentially.
None	■ The respective internal battery is not installed. ■ The respective battery has failed. ■ The monitor is powered by the external power supply. ■ The monitor is powered by the respective internal battery.

Battery In Use

There are two battery-in-use indicators; one inside each battery door.

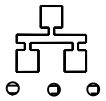
Color	Description
Green	The monitor is powered by the internal battery. If the indicators for both batteries are illuminated, the monitor is in a very low battery condition and must run off both batteries to sustain power.
None	■ The monitor is powered by the external power supply. ■ The monitor is powered by both batteries simultaneously.

Alarm Light

Color	Description
Yellow	Flashes for warning patient status alarms and system status alarms.
Red	Flashes for crisis patient status alarms.

Main Processor Diagnostic LEDs

The main processor PCB provides three diagnostic LEDs to help troubleshoot the monitor. The LEDs are viewable on the back of the monitor under the **Ethernet** connector.



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Color	Description
Green	There is communication with an acquisition device.
Flashing Green	The monitor is running the Boot Loader program.
Yellow	The main code is running.
Red	The boot code is running.

Connectors

Video In

The Video In connector provides communication between a TRAM module and the monitor.

Ethernet

The Ethernet connector is used to download software updates from a personal computer.

DC Power

The DC power connector provides power to the monitor via an external power supply. Connect the external power supply to the connector and to an electrical outlet to power the monitor and an acquisition device or charge the monitor's internal batteries.

ePort

The ePort connector will provide communication and power between acquisition devices and the monitor in future releases.

Basic Components

Monitor

The monitor consists of the following components:

- Display assembly, including the flat-panel display and the control panel.
- Processing unit.
- Processor/power management circuit board and speaker.
- Back plastic.

The subsystems within the monitor operate from a common 9 to 18 V power bus. Due to the wide variety of voltages required by the various subsystems, power is converted locally by each subsystem. This architecture results in an efficient and compact system by reducing the number of conversions required and optimizing the physical size of each converter for the specific application.

When operating on external power, the power bus voltage is 16.75 V, generated by the external power supply.

No external power switch is provided.

Batteries

The monitor is designed to operate on battery power during transport or whenever AC power is interrupted. A complete battery management system allows you to obtain maximum battery performance. Audible and visual alarms alert you when loss of power is imminent. Capacity gauges display battery charge condition and capacity on the monitor.

For more information on battery use, refer to the operator's manual.

External Power Supply

The external power supply provides power to the monitor and to the acquisition device by converting AC power into 16.75 V DC power. When the internal batteries are inserted, the external power supply charges the batteries.

The line voltage range of the external power supply is 100 to 240 V AC.

TRAM Chute

A TRAM chute is used to secure one TRAM module to the monitor during patient transport.

TRAM Module

The monitor uses one TRAM module installed in the TRAM chute to acquire patient data. The following TRAM modules are compatible, if running software version 9B or later.

Module	Part Number
TRAM 100	401174-0 _ _
TRAM 200A SL	T200= _
TRAM 250 A SL	T250= _
TRAM 350A	416646-001
TRAM 400A SL	T400= _
TRAM 450A SL	T450= _
TRAM 451	2006171-001
TRAM 451N	2006171-002
TRAM 451M	2006171-003
TRAM 500	402593-0 _ _
TRAM 600 A SL	T600= _
TRAM 650 A SL	T650= _
TRAM 800 A SL	T800SL= _
TRAM 850	T850= _
TRAM 850 A SL	T850SL= _
TRAM 851	2006171-004
TRAM 851N	2006171-005
TRAM 851M	2006171-006

TRAM Communication Cable

The TRAM communication cable provides a communication and power pathway between the TRAM module and the monitor.

Optional Component

Cadex SMart Two+ External Battery Charger

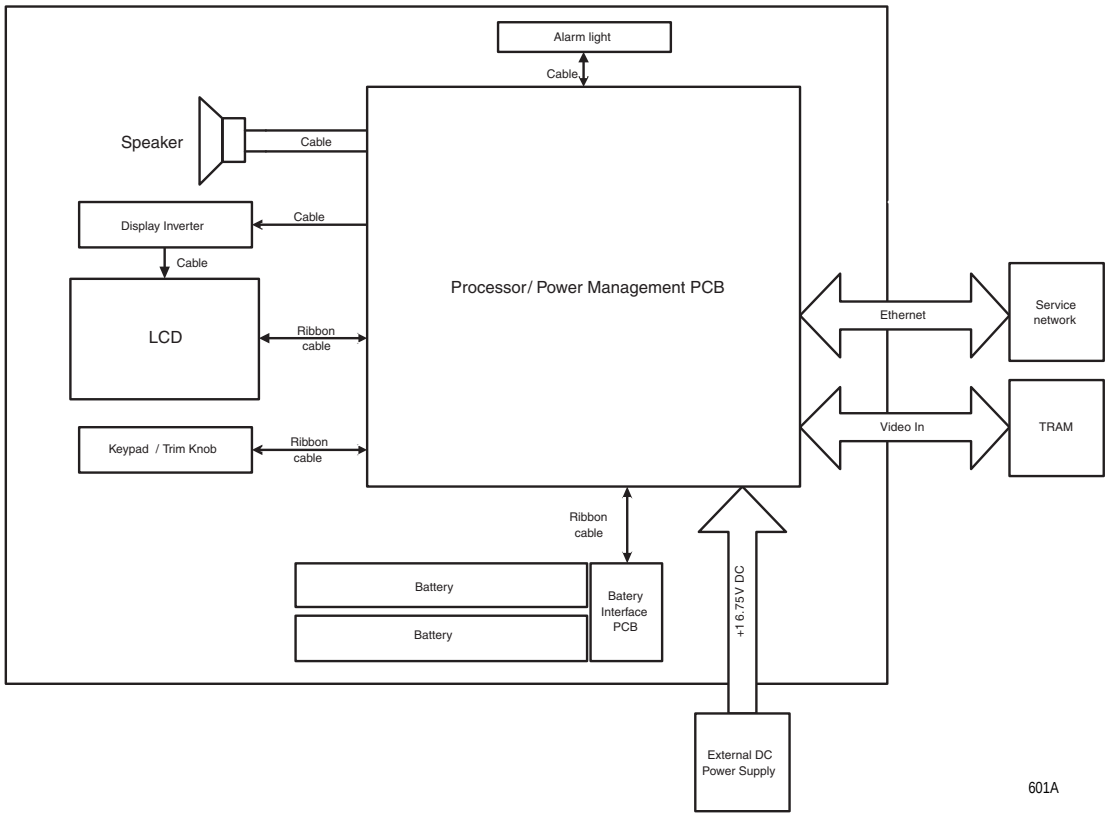
The external battery charger can hold and charge up to two batteries. When you select the **Target Capacity** switch on the charger, the charger compares the battery's performance to a 60, 70 or 80 percent of the target capacity set on the battery charger. If the battery fails to meet the target performance, the battery charger will prompt you to condition the battery. If the battery does not hold a charge, then the battery charger will illuminate a "fail" light.

Theory of Operation

The monitor is a portable monitor used to display patient parameters and data during patient transport.

Two rechargeable, lithium-ion batteries provide power to the monitor during transport. An external power supply connector is available to power the monitor from an AC power source and to recharge the batteries.

An asynchronous communication port is provided for communications with a TRAM. An Ethernet port is provided for use during software downloads.



Processor/Power Management

The processor/power management circuit board provides processing memory, user interface, communication channels, power and rechargeable battery hardware functions for the monitor.

The processor/power management circuit board assembly consists of the processor/power management circuit board, LCD backlight inverter circuit board, alarm light circuit board, battery interface circuit board and speaker. These items are mounted in an open-ended sheet metal box for additional EMI shielding.

LCD Backlight Inverter

The LCD backlight inverter is a DC to AC inverter for a dual lamp LCD. The input voltage is rated at +8 to +18 V DC and the output voltage is rated at 400 to 600 VRMS. The start voltage is 1400 VRMS and the lamp current is 7 milliampere per tube.

Alarm Light

The alarm light circuit board provides an alarm light in the monitor's bezel. The input voltage is rated +5 V DC. It transmits two control signals, one for red LEDs and another for yellow LEDs.

Battery Interface

The battery interface circuit board provides power connections for the two internal batteries for charge/discharge. It also controls battery status communication with the monitor.

Speaker

The speaker is used for audible notification of alarms. It is 66 mm square, water-resistant, 3 watt, with a frequency response of 400 to 4500 Hz.

3 Installation

Location Requirements

- Choose a location that affords an unobstructed view of the display and easy access to the operating controls.
- To optimize battery life and performance, choose a location that does NOT artificially increase the ambient temperature surrounding the monitor.
  - Do not place the monitor near a heat vent or near heat-generating equipment, such as computer monitors.
  - Avoid placing the monitor in corners where the airflow may be restricted.
- Set up the device in a location that affords sufficient ventilation. The ventilation openings of the device must not be obstructed (by external equipment, walls or blankets, for instance). The ambient conditions specified in the technical specifications must be ensured at all times.
- The monitor is designed to comply with the requirements of EN 60601.

WARNING
When connected to AC power, the monitor must be connected to a properly installed electrical outlet with protective earth contacts only. If the installation does not provide for a protective earth conductor, disconnect the monitor from the power line and operate it on battery power.

WARNING
For safety reasons, all connectors for patient cables and sensor leads are designed to prevent inadvertent disconnection, should someone pull on the leads. Do not route cables in a way that they may present a stumbling hazard. Do not install the monitor in a location where it may drop on the patient. All consoles and brackets used must have a raised edge.

Battery

To install the battery, follow this procedure.

1. Press the TEST button on the battery. The number of charge level indicator LEDs that illuminate indicates the approximate charge remaining in the battery.

Illuminated LEDs	Percentage of Full Charge Capacity
Four	75 to 100 percent
Three	50 to 74.9 percent
Two	25 to 49.9 percent
One steady	10 to 24.9 percent
One flashing	Less than 10 percent

2. Open the battery door by gently pulling on the battery door pull tab.
3. If a battery is present, gently pull the battery strap to remove the existing battery.
4. Insert the battery.

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   a. Insert the connector end of the battery into the battery slot. Verify the connector ends are facing the back of the monitor and the **Test** LEDs on the battery are facing the front of the monitor.
   b. Push the battery firmly into the slot.
5. Gently push the battery door closed until it “snaps” into position. The battery door will not close if the battery is not fully inserted into the battery slot.
6. Confirm that the battery gauge displays.
7. Verify the green or amber battery **Charging Status** indicator is illuminated, if on AC power.

Software

The monitor leaves the factory with software installed. If you need to install the software, refer to the instructions provided with the software installation kit.

Mounting Options

There are two mounting options, bedrail and IV pole. For mounting instructions, refer to the installation instructions included in the mounting kit.

4 Configuration

Introduction

To configure the monitor, define each of the monitor settings listed in the order given below.

- Set Patient-Monitor Type.
- Set Monitor Defaults Password.
- Set Unit Name.
- Set Bed Number.
- Set Country Selection.
- Set Language.

Refer to the operator's manual to configure the monitor for clinical use.

General

Service Password

The service password is the date and month of the monitor (e.g. July 4 is 0407).

Boot Loader Access

Many of the configuration settings are made in the Boot Loader program. To access the Boot Loader program, follow this procedure.

1. Hold down **NBP Go/Stop** and **Zero All**.
2. Press and release the **TRIM KNOB** control.
3. Keep holding **NBP Go/Stop** and **Zero All** until the Boot Loader program appears on the display.

Reboot

Many of the configuration settings do not take effect until the monitor is rebooted. To reboot the monitor, follow this procedure.

1. Hold down **NBP Go/Stop** and **Zero All**.
2. Press the **TRIM KNOB** control.
3. Release all when the display goes blank.

Monitor Settings

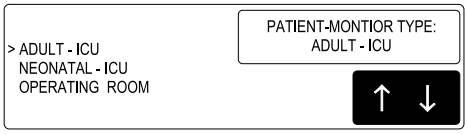
Patient-Monitor Type

WARNING
Changing the patient-monitor type will default the admit function to Standard configuration. Different alarms and parameters are activated for each selection.

The patient-monitor type defines the type of monitor desired (i.e adult, neonatal or operating room). The patient-monitor type displays on the top left of the display, immediately after the date and time.

To set the patient-monitor type, follow this procedure.

1. Select *MORE MENUS > MONITOR SETUP > SERVICE MODE.*
2. Use the **TRIM KNOB** control to enter the service password.
3. Select *PATIENT-MONITOR TYPE.*



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4. Select *ADULT-ICU*, *NEONATAL-ICU* or *OPERATING ROOM.*
5. Press the **TRIM KNOB** control to exit.

Monitor Defaults Password

The monitor defaults password defines whether or not a password is required to change the monitor's defaults. If selected, the password will be the same as the Service Mode menu password.

To define the monitor defaults password option, follow this procedure.

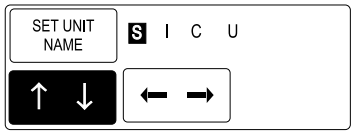
1. Select *MORE MENUS > MONITOR SETUP > SERVICE MODE.*
2. Use the **TRIM KNOB** control to enter the service password.
3. Select *MENU SETUP > MONITOR DEFAULTS PASSWD.*
4. Select either *REQUIRED* or *NOT REQUIRED.*
5. Press the **TRIM KNOB** control to exit.

Unit Name

The unit name identifies the care unit (up to seven characters). The unit name displays at the top right of the display before the bed number.

To define the unit name, follow this procedure.

1. Select *MORE MENUS > MONITOR SETUP > SERVICE MODE.*
2. Use the **TRIM KNOB** control to enter the service password.
3. Select *MONITOR SETTINGS > UNIT NAME.*



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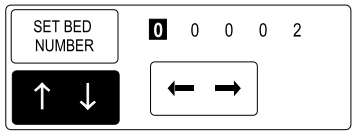
4. Use the **TRIM KNOB** control to select up to seven characters.
5. Select *SET UNIT NAME* and press the **TRIM KNOB** control to exit.

Bed Number

The bed number identifies a particular patient bed (up to five characters). The bed number displays at the top right of the display after the unit name.

To define the bed number, follow this procedure.

1. Select *MORE MENUS > MONITOR SETUP > SERVICE MODE.*
2. Use the **TRIM KNOB** control to enter the service password.
3. Select *MONITOR SETTINGS > SET BED NUMBER.*



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4. Use the **TRIM KNOB** control to select up to five characters.
5. Select *SET BED NUMBER* and press the **TRIM KNOB** control to exit.

Country Selection

The country selection defines a particular set of GE factory defaults. There are two options: *DEFAULT* or *FRANCE.*

To select the country, follow this procedure.

1. Access the Boot Loader program.
2. Select *SET CONFIGURATION > Country Selection*.

3. Select *DEFAULT* or *FRANCE*.
4. Reboot the monitor to display the new factory defaults.

Language

The language determines the language of all text displayed on the monitor.

To select the language, follow this procedure.

1. Access the Boot Loader program.
2. Select *SET CONFIGURATION > SET LANGUAGE*.
3. Select the appropriate language.
4. Reboot the monitor to display the new language.

5 Maintenance

Maintenance Schedule

Manufacturer Recommendations

To help ensure the equipment remains in proper operational and functional order, adhere to a good maintenance schedule. The manufacturer recommends that the following be performed by service personnel upon receipt of the equipment, every 12 months thereafter, and each time the monitor is serviced:

- Visual Inspection.
- Cleaning.
- Battery Maintenance.
- Electrical Safety Tests.
- Checkout Procedures.

Manufacturer Responsibility

WARNING
Failure on the part of all responsible individuals, hospitals or institutions, employing the use of this device, to implement the recommended maintenance schedule may cause equipment failure and possible health hazards. The manufacturer does not, in any manner, assume the responsibility for performing the recommended maintenance schedule, unless an Equipment Maintenance Agreement exists. The sole responsibility rests with the individuals, hospitals, or institutions utilizing the device.

Maintenance Checklist

Use the following checklist to ensure maintenance completion.

☐ "Visual Inspection" on page 5-4.

1. "General" on page 5-5.
2. Connectors.
3. Display
4. Labels
5. Hardware

☐ "Cleaning Recommendations" on page 5-5.

☐ "Battery" on page 5-5.

☐ "Electrical Safety Tests" on page 9-2.

1. "Power Outlet" on page 9-3.
2. "Ground (Earth) Integrity" on page 9-4.
3. "Ground (Earth) Wire Leakage Current" on page 9-5.
4. "Enclosure Leakage Current" on page 9-6.
5. "Patient (Source) Leakage Current" on page 9-8.
6. "Patient (Sink) Leakage Current" on page 9-9.
7. "Power Cord and Plug" on page 9-10.

☐ "Recommended Tests and Checkout Procedures" on page 9-10.

1. "Power Test" on page 9-11.
2. "Battery Function Test" on page 9-12.
3. "Video Test Screens" on page 9-13.
4. "Brightness Level Test" on page 9-13.
5. "Speaker Test" on page 9-13.
6. "TRAM Communication Test" on page 9-13.

Inspection and Cleaning

Remove power and all cables before inspecting or cleaning the equipment.

Visual Inspection

Inspect the equipment and its components carefully prior to installation, once every 12 months thereafter and each time the equipment is serviced.

- Carefully inspect the equipment for physical damage to the case, the display and the controls. Do not use the equipment if damage is determined. Refer damaged equipment to qualified service personnel.
- Inspect all external connections for loose connectors or frayed cables. Have any damaged connectors or cables replaced by qualified service personnel.
- Inspect the display face for marks, scratches, or other damage. Physical damage to a LCD touchscreen face may jeopardize its performance. Have the LCD replaced by qualified service personnel if necessary.
- Safety labels and inscription on the device are clearly legible.
- Check for loose or missing screws on the mounting hardware.

Cleaning Cautions

Improper cleaning methods can result in degradation of the equipment performance and/or failure. To avoid damage to the equipment:

- Never use conductive solutions, solutions that contain chlorides, wax, or wax compounds to clean the equipment.
- Never immerse equipment in any liquid.
- Never pour any liquid on the equipment or permit fluid to seep into connections or openings.
- Never use the following solutions:
  - Acetone
  - Betadine
  - Methylene chloride
  - Methyl ethyl ketone
  - Hexane
  - Lysol
  - Sporicidin
  - Ammonia-based glass cleaners
  - Alcohol-based cleaning agents
  - Abrasive cleaners or solvents of any kind
- Never autoclave or steam clean the equipment.

Cleaning Recommendations

CAUTION
Failure to follow these rules may melt, distort, or dull the finish of the case, blur lettering on the labels, or cause equipment failures.

Remove power, batteries and all cables before cleaning the equipment. Wipe the equipment with a soft, lint-free cloth and one of the following approved cleansers:

- Cidex solution
- Sodium hypochlorite bleach (diluted)
- Mild soap (diluted)

In addition, follow these guidelines:

- Always dilute cleaning solutions per manufacturer's recommendations.
- Wring excess solution from the cloth before wiping the equipment. Do not drip any liquid into open vents, plugs, or connectors.
- Always wipe off cleaning solutions with a clean, dry, lint-free cloth or let air dry for at least 15 minutes.
- Do not let fluid "pool" around connection pins. If this happens, blot dry with a cotton swab or soft cloth.
- Use compressed air to remove dust from connectors and vents.

Battery

General

The lithium-ion battery is a rechargeable battery containing lithium-ion cells. Each battery contains an integrated electronic fuel gauge and a safety protection circuit. The processor within the equipment communicates with both the battery and the charger via the SMBUS 2-wire serial interface.

The following are the key points you should know about lithium-ion battery technology:

- The battery will discharge on its own, even when it is not installed in the equipment. This discharge is the result of the lithium-ion cells and the bias current required for the integrated electronics.
- The self-discharge rate doubles for every 10°C (18°F) rise in temperature.
- The capacity loss of the battery degrades significantly at higher temperatures.
- As the battery ages, the full-charge capacity of the battery will degrade and be permanently lost. As a result, the amount of charge that is stored and available for use is reduced.

The following terms are used to define the battery capacity:

- Design capacity — The theoretical capacity of the battery cells when the battery is new.
- Full charge capacity — The actual amount of charge the battery can store and deliver.
- Remaining charge capacity — The amount of full charge capacity currently remaining in the battery. This is a percent of full charge capacity.

Use Recommendations

GE recommends the following methods to improve battery performance:

- Location — Position the equipment in a location that does not artificially increase the operating temperature of the batteries.
- Charging method — Whenever possible, use the Cadex SMart Two+ charger to charge the battery. This charger maintains a lower battery cell temperature during the charge cycle. This reduction in temperature can extend the life of the battery.
- Conditioning guideline — Remove the batteries from the equipment every six months and condition it using the Cadex SMart Two+ charger. This condition cycle recalibrates the electronic fuel gauge.

NOTE

For clinical use guidelines on charging, conditioning, or other daily use of batteries, refer to the operator's manual.

Storage Recommendations

Store the battery outside of the device at a temperature between 20 to 25°C (68 to 77°F).

- When the battery is stored inside a device that is powered by an AC power source, the battery cell temperature increases by 10 to 15°C (18 to 27°F) above the room's ambient temperature. This reduces the life of the battery.
- When the battery is stored inside a monitor that is continuously powered by AC power source and is not powered by battery on a regular basis, the life of the battery may be less than 12 months. GE recommends that you remove the battery and store it near the monitor until it is needed.

Waking Up

When the battery is stored for a long period of time without being charged, it will eventually lose all of its charge and "fall asleep". When the battery is asleep, the LEDs on the battery do not illuminate.

External

GE recommends using the Cadex SMart Two+ Charger to wake up a battery. To wake up a battery, follow this procedure.

1. Insert the battery into the battery charger.
2. Wait approximately three minutes for the **RUN** LED to illuminate. If it does not illuminate, follow this procedure.
   a. Remove the battery from the battery charger.
   b. Insert the battery into the battery charger and let the battery charge for two to three minutes. The **FAIL** LED will flash.
   c. When the **FAIL** LED stops flashing or both the **RUN** and **CONDITION** LED illuminate, remove the battery from the battery charger.
   d. After a few seconds, insert the battery in the battery charger. The RUN and CONDITION LEDs will flash for five to ten seconds. If the FAIL LED illuminates, remove and reinsert the battery.
   e. When the RUN and CONDITION LEDs remain illuminated for one minute, the battery is “awake”.

   NOTE
   You may have to repeat these steps more than once for a battery that has been sleep for a long time.
3. Charge the battery.

Internal

GE recommends using the Cadex SMart Two+ Charger to wake up a battery. To wake up a battery inside the monitor, follow this procedure.

1. Connect the external power supply to the DC power connector on the monitor.
2. Connect the external power supply to an electrical outlet.
3. Access the Boot Loader program.
4. Select *Wake Up Battery*.
5. Insert the asleep battery in battery slot A.
6. Select Wake Up Lithium Ion Battery in SLOT A. This applies a current to the battery for up to 210 seconds.
7. When the message “Battery awake, run main code to charge” displays, reboot the monitor.
8. Charge the battery.

If the battery does not charge, repeat the procedure.

NOTE
The monitor will not charge a battery while in the Boot Loader program.

Repair Log

Use the repair log to record the repair history of this product.

Monitor Serial Number:
Institution Name:

Date	Maintenance/Repair	Technician

6 Troubleshooting

Overview

The symptoms and solutions in this chapter represent only a few of the faults that you may encounter and are not intended to cover every possible problem that may occur.

A systematic approach to the diagnosis of problems as well as a general understanding of the architecture, both hardware and software, of the monitor are essential to ensure successful troubleshooting of a device. GE recommends formal service training before repairs are attempted. These troubleshooting procedures combined with training provide the service technician with skills necessary to service and repair a monitor in the event of a malfunction.

Required Tools/Equipment

- Standard set of hand tools.
- Digital multimeter.

Problems

Before starting any detailed troubleshooting, complete a thorough visual inspection of the following.

- All cable connections secure?
- Devices properly powered?
- Connected to a proper power source?

Problem	Solution
Alarms	"Audible Alarms" on page 6-2.
Alarm light	"Alarms Light" on page 6-3.
Display blank	"Display Blank" on page 6-3.
Display dim	"Display Dim" on page 6-4.
No parameters/patient data/ waveforms	"Missing/Inaccurate Patient Data/Waveforms" on page 6-5.
Speaker buzz	"Speaker Buzz" on page 6-5.
Unresponsive buttons	"Unresponsive Buttons" on page 6-5.

Audible Alarms

1. Press the **Silence Alarm/Admit** key and check for audio feedback.
2. If there is audio feedback, adjust alarm volume. If there is not audio feedback, check speaker cable connection.
3. If the connection is good, check speaker resistance.
   a. Disconnect the speaker cable.

b. Measure the resistance between the two pins:

- If it is between 6 and 8 ohms, replace the main processor FRU.
- If not between 6 and 8 ohms, replace the speaker FRU.

Alarms Light

1. Check alarm light cable and cable connection integrity.
2. If the cable is bad, replace alarm light FRU.
3. Check the alarm light circuit board.
   a. (No light) If the jumper JP1 is missing, replace the jumper.
   b. (Dim) Check the alarm light circuit board for LEDs that are not lit. If not lit, replace the alarm light FRU.
   c. (Always on) With the alarm light cable disconnected, check for shorts between pins 1 and 3 and pins 3 and 2.
   - If shorted, replace the alarm light FRU.
   - If not shorted, proceed to next step.
4. Unplug the alarm light circuit board and check resistance on main processor board from J16 pin 1 to ground (red) and from J16 pin 3 to ground (yellow).
   - If resistance is less than 10k ohms, replace the main processor FRU.
   - If equal to or greater than 10k ohms, replace the alarm light FRU.

Display Blank

Battery Powered

1. If the control panel lights are off, check the battery. See "Battery Function Test" on page 9-12. Replace or recharge as necessary.
2. If the control panel lights are on, check the cable connections between the inverter and display and the cable connection between the main processor and inverter.
3. If the connections are ok, replace main processor FRU.

External Power

1. If the control panel lights are off, check if the power supply LED is illuminated.
   a. If the power supply LED is on, check the connection to monitor.
   b. If the power supply LED is off, check the AC power cord connection.
   - If all connections are good, replace the power supply.
   - If problem persists, replace the main processor FRU.

2. If the control panel lights are on, press the power button to make sure monitor is not in standby mode. If display is still blank, cycle monitor power and check the main processor status LEDs.
   - If the red and yellow LEDs are on, check the main processor cable connections.
   - If the LEDs are off, replace the main processor FRU.
3. If main processor connections are good and backlight is on, replace the main processor FRU. If backlight is off, measure the voltage between J11 pin 1 or 2 and J11 pin 3 or 4 on the main processor board.
4. If voltage is not between +9 and +18 V, replace the main processor FRU. If within range, check the voltage between J11 pin 5 and J11 pin 3 or 4 on main processor board.
5. If voltage is not between +4.5 and +5.5 V, replace the main processor FRU. If within range, replace the inverter FRU.

Display Dim

1. Clean the display.
2. Adjust the brightness.
3. Check the voltage between J11 pin 6 (+) and J11 pin 3 (–) on the main processor with brightness set to 100 percent.
4. If voltage is greater than 2.3 V, replace the inverter board. If this does not remedy the problem, replace the display FRU. If voltage is less than 2.3V, replace the main processor FRU.

Display Flickering

1. Check the inverter to display and inverter to main processor connections.
2. If connections are ok, check the inverter board cables for damage.
3. If the cable from the main processor board to inverter is damaged, replace the inverter FRU.
4. If the cable from the display to inverter is damaged, replace the display FRU.
5. If no cables are damaged, replace the inverter FRU.

Display Bad Quality

1. Perform video test in the Boot Loader program.
2. If any of the video screens look bad, replace the display FRU. If all video screens look good, this is a customer preference issue.

Missing/Inaccurate Patient Data/Waveforms

1. Refer to operator's manual for detailed information on patient preparation and electrode placement.
2. Change the sensitivity level. Usually a lower percentage rectifies the problem.
3. Test the patient cable on a known working device. If the patient cable is defective, replace.
4. Test the patient connector with a patient simulator. If the patient connector is defective, replace the acquisition device.

Speaker Buzz

During Alarms

1. Reboot the monitor.
2. Reseat speaker cable connection.
3. Verify that speaker and/or cable is not damaged.
4. If speaker or cables are damaged, replace the speaker FRU.
5. Unplug speaker and check speaker cable resistance.
6. If resistance is between 6 and 8 ohms, replace the main processor FRU.
7. If resistance is outside 6 and 8 ohms, replace the speaker.

Always

1. Reboot the monitor.
2. Replace the main processor FRU.

Unresponsive Buttons

1. Reboot the monitor.
2. Connect a known good power supply.
3. Reseat the keypad harness connection.
4. Verify that the keypad harness is not damaged.
5. If the keypad harness is damaged, replace the front bezel.
6. If the keypad harness is not damaged, replace the main processor FRU.

Error Messages

The following table describes error messages that may appear and how to resolve the problem.

Message	Possible Reason/Solution
"WARNING: The EEPROM data was found to be either INVALID or uninitialized. GE factory defaults will be stored in both the EEPROM and the monitor's configuration memory. You will be required to re-enter the network configuration, re-enable any password protected features and restore all monitor settings and site-specific defaults."	1. Restore Ethernet address and IP address. 2. Power cycle. 3. Access Boot Loader and restore all monitor settings and site-specific defaults via *Set Configuration* and *Options Menu*. 4. If error message persists, replace the main processor FRU.
"WARNING: THIS VERSION OF BOOT CODE IS NOT COMPATIBLE WITH THE VERSION OF MAIN CODE CURRENTLY STORED IN FLASH. PLEASE UPDATE THE BOOT CODE."	1. Power cycle. 2. Reload Boot Code. 3. If problems persists, replace the main processor FRU.
"Boot Flash test FAILED." *"ERROR: The Boot Code stored in Flash is not valid. Main Code cannot be loaded until valid Boot Code exists."*	
"Main Flash test FAILED." *"ERROR: The Main Code stored in flash is not valid."*	
"Static RAM test FAILED." *"ERROR: The SRAM memory test failed. Main Code will not be loaded unless this test passes. Reboot the monitor to repeat testing."*	1. Power cycle. 2. If problems persists, replace the main processor FRU.
"Real Time Clock FAILED - will not start." *"WARNING: The real time clock chip is not running. Main Code cannot be loaded until this chip is started. Attempting to start real time clock..."* Followed by either: *"The real time clock was started. Select Start Patient Monitoring to load and execute Main Code."* Or *"ERROR: Unable to start the real time clock."*	
PREVENTIVE MAINTENANCE REQUIRED	Perform all of the maintenance procedures.
Internal lithium battery is LOW. This message displays during power up. After the power-up tests, the following message displays in the *BOOT LOADER* program: *ONE OR MORE POWER-UP TESTS HAVE FAILED ** SERVICE MAY BE REQUIRED ** DO YOU WISH TO CONTINUE MONITORING ANYWAY?*	■ The main processor battery may be depleted. Remove this monitor from service and contact GE. ■ The battery switch on the main processor FRU may be off. ■ If problems persists, replace the main processor FRU.

Power Sources

The monitor can be powered from its two batteries, TRAM power or by an external AC power supply. It automatically switches power sources as they are depleted or removed.

The monitor uses the following pattern to sustain power:

1. The monitor's external power supply.
2. The monitor's battery power.
3. The acquisition device's power.

It uses the internal battery with the lowest capacity to power the system first. It only uses the acquisition device batteries to power the monitor if there are no internal batteries or the internal batteries have capacities too low to support proper operation.

The monitor also provides power to a acquisition device via its battery power or external AC power source.

Service Menu

These service menus track and log information that may be helpful for some troubleshooting scenarios.

WARNING
The Boot Loader Service Menu and the Service Mode menu are intended for qualified personnel only. It is possible to lose patient data and damage the operating software for this monitor. Do not 'experiment' with any service menu commands.

Qualified field engineers and factory service personnel use the service menus to troubleshoot, repair, or download new software to the monitor.

Only persons responsible for configuring and maintaining the monitor should access the service menus. ALWAYS use caution when using any of these protected functions.

Refer to "General" on page 4-2 for password, Boot Loader access and reboot instructions.

Boot Loader Service Menu

Use the Boot Loader service menu to download software. The Boot Loader service menu contains the following options:

Menu Option	Description
CHANGE SERVICE PORT INTERNET ADDRESS	Change the monitor's IP address for software upgrades.
SET CONFIGURATION	Select country (not for text translation) and language setting for displayed text.
VIDEO TEST SCREENS	Test display's color resolution.
BATTERY SIMULATION	For GE engineering use only.
WAKE UP BATTERY	Wake up a battery.
OPTIONS MENU	Clear the configuration memory (erases all patient histories and reset all defaults to the factory installed defaults).

Service Mode Menu

Use the Service Mode menu to:

- Configure the monitor.
- Review errors.
- Access battery information.

To access the Service Mode menu, select *MORE MENUS* > *MONITOR SETUP* > *SERVICE MODE* and enter the password. The following Service Mode menu options display.

Menu Option	Description
REVIEW ERRORS	Review input and output error information (GE engineering only).
BATTERY SERVICE	Review battery data for the internal monitor batteries.
PATIENT-MONITOR TYPE	Select the type of monitor (i.e adult, neonatal or operating room).
MENU SETUP	Define if a password is required to access the *Monitor Defaults* menu.
MONITOR SETTINGS	Set the unit name and bed number.

Review Errors

The Review Errors menu is an advanced troubleshooting tool used by GE engineering personnel to review error logs.

Error logs record operating system events that impact the system function. Tech Support may request error logs when troubleshooting a monitor. Contact Tech Support if you need clarification of any of the error logs.

An error log can hold up to 50 events, in the order the event occurred. When the 50 event limit is reached, subsequent events replace the earliest event(s) in the log.

To access the error logs, follow this procedure.

1. From the Main Menu, select *Monitor Setup* > *Service Mode*.
2. Enter the service password.
3. Rotate and press the **TRIM KNOB** control to select *REVIEW ERRORS* from the Service Mode Menu.
4. To view the error logs, rotate and press the **TRIM KNOB** control to select either of the following:
   - *VIEW OUTPUT ERRORS* — Displays time-dated output software errors in the Run Time Error Log pop-up window.
   - (TRAM only) *VIEW INPUT ERRORS* — Displays time-dated input software errors in the Run Time Error Log pop-up window.
5. Use the **TRIM KNOB** control to scroll through each logged error. The following parameters display for each error.

Parameter	Description
PROCESS NAME	The task that was operating when the event or problem occurred.
ERROR CODE	A software code for the type of event or problem that occurred.
SEVERITY	Indicates the level of impact of the event or problem on the system. ■ *CONTINUE* — The event or error was logged, the task may or may not have completed, but the system was able to continue operating. Most error log entries have this severity level. ■ *FATAL* — The event or error was logged, the task did not complete, and the system was unable to continue operating as recovery was not possible. This level of severity in an event or error is always followed by an automatic warm start. ■ *FORCED RESET* — The operating system restarted normally after a known condition, such as an Internet address change, patient discharge, etc.
DATE	The date the event or problem occurred.
TIME	The time the event or problem occurred.

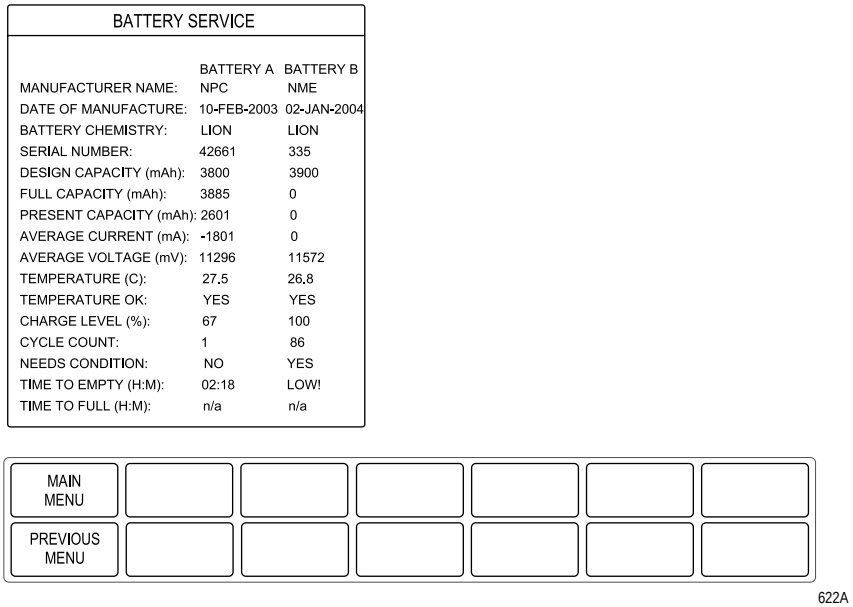
Parameter	Description
ERROR NUMBER	A sequential number used to identify each event or problem.
INPUT ERROR	Additional information used to determine the cause of the error.

6. To clear the error logs, rotate and press the **TRIM KNOB** control to select either of the following:
   - *CLEAR OUTPUT ERRORS* — Clears the stored output run time error logs.
   - (TRAM only) *CLEAR INPUT ERRORS* — Clears the stored input run time error logs.

Battery Service

The Battery Service menu provides you with non real-time information about the monitor's internal batteries. It does not provide information about connected TRAM batteries.

1. Select *MORE MENUS* > *MONITOR SETUP*.
2. Select *SERVICE MODE* and enter the password.
3. Select *BATTERY SERVICE*.


BATTERY SERVICE
BATTERY A BATTERY B
MANUFACTURER NAME: NPC NME
DATE OF MANUFACTURE: 10-FEB-2003 02-JAN-2004
BATTERY CHEMISTRY: LION LION
SERIAL NUMBER: 42661 335
DESIGN CAPACITY (mAh): 3800 3900
FULL CAPACITY (mAh): 3885 0
PRESENT CAPACITY (mAh): 2601 0
AVERAGE CURRENT (mA): -1801 0
AVERAGE VOLTAGE (mV): 11296 11572
TEMPERATURE (C): 27.5 26.8
TEMPERATURE OK: YES YES
CHARGE LEVEL (%): 67 100
CYCLE COUNT: 1 86
NEEDS CONDITION: NO YES
TIME TO EMPTY (H:M): 02:18 LOW!
TIME TO FULL (H:M): n/a n/a
MAIN MENU
PREVIOUS MENU

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NOTE

If there is only one internal battery, no information will display in the Battery B column.

7 Ordering Parts

Overview

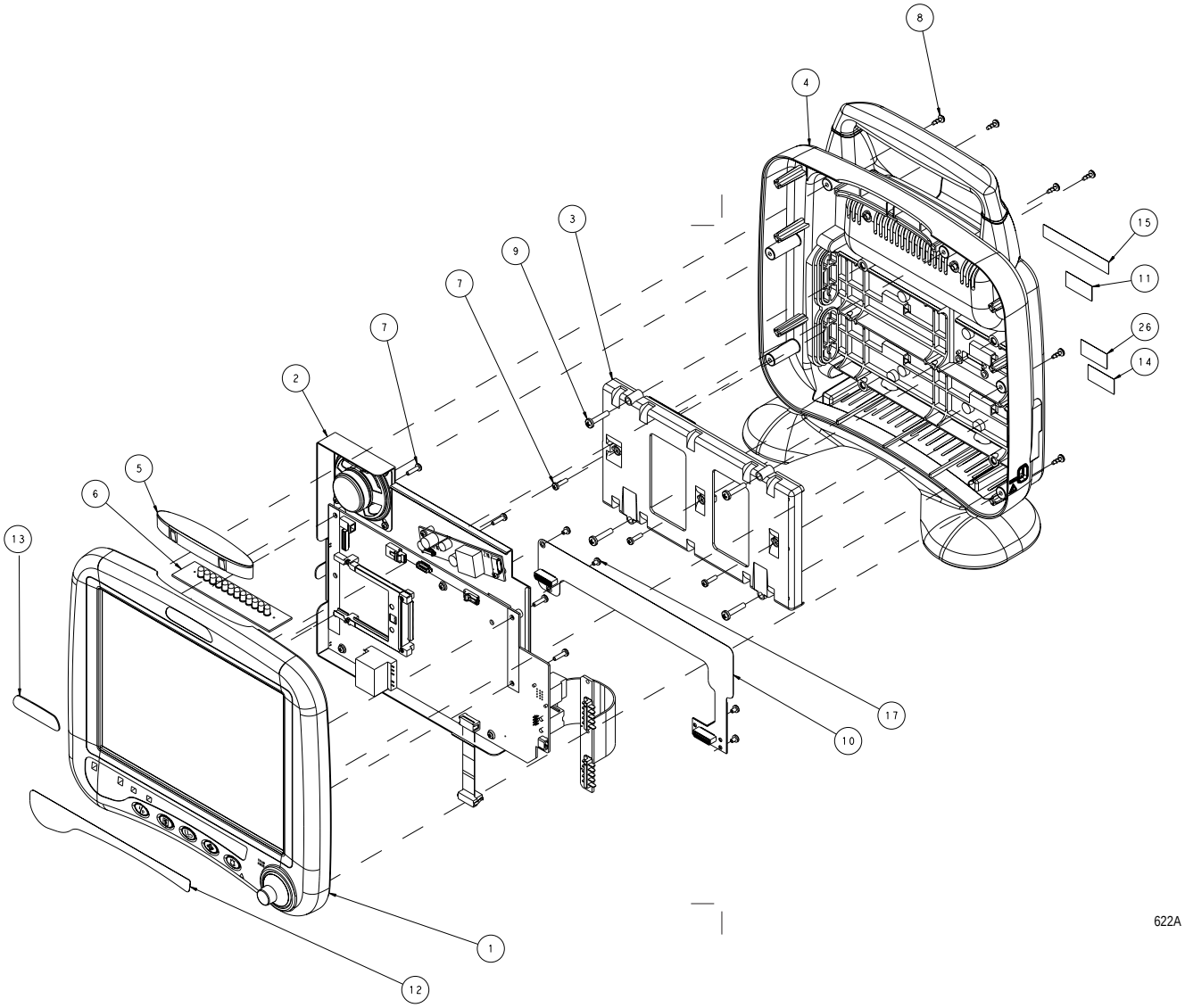
The parts lists and assembly drawings in this chapter supply enough detail for you to order parts for the assemblies considered field serviceable.

If you require additional information or troubleshooting assistance, contact GE Technical Support.

To order parts, contact Service Parts at the address or telephone number listed on the “How to Reach Us...” page found in the front of this manual.

For the latest parts information, including substitutions, obsolescence and compatibility, please visit our Parts ID Portal website: http://egems.gehealthcare.com/partsiduser/gems/Welcome.jsp

Exploded View



Field Replaceable Units

Item	Part Number
Display subassembly[1]	2021926-002
Front plastic subassembly[2]	2021926-003
Main processor PCB subassembly[3]	2021926-004
Inverter PCB subassembly[4]	2021926-005
Alarm light subassembly[5]	2021926-006
ePort flex circuit	2021926-007
Foot and battery doors	2021926-008
Handle	2021926-009
Hardware — “Hardware” on page 7-5.	2021926-010
TRAM chute	2021926-011

1. Includes display, front bezel, labels and keypad.
2. Includes front bezel, labels and keypad.
3. Includes CPU, main processor PCB shield, PCB subassembly and speaker.
4. Includes inverter and inverter harness.
5. Includes speaker, alarm light PCB, lense and alarm light cable.

Accessories

Item	Part Number
Bedrail hook mount kit	2007665-002
IV pole mounting kit	2021966-001
External power supply	2012183-001
Rechargeable lithium-ion battery (11.1 V)	2017857-002
Cadex SMart Two+ battery charger	2017857-002
Standard category 5 cross-over cable	415480-001
TRAM communication cable	403496-001

Software

The monitor leaves the factory with the software installed.

Item	Part Number
Software version 2.0 upgrade kit	2017716-017

Hardware

Item	Where Used	Quantity	Part Number
Phillips-head screw #6-10	Back plastic	6	402440-002
Phillips-head screw M3 X 14 with thread lock	■ Shield (4) ■ Battery housing (3)	7	409914-002
Phillips-head screw M2 X 12 with thread lock	PCMCIA	4	411508-007
Hex nut M2	PCMCIA	4	411509-001
Phillips-head screw M3 X 4 with thread lock	■ ePort flex circuit to shield (2) ■ ePort flex circuit to back plastic (2) ■ Speaker (4) ■ Inverter (2) ■ Processor PCB (4)	14	2000540-007
Phillips-head screw M3 X 6 with thread lock	■ LCD mounting brackets (4) ■ Foot (2)	6	2000540-001
Phillips-head screw M4 X 25 with thread lock	Handle	4	2000543-001
Phillips-head screw M4 X 14 with thread lock	TRAM chute	1	2000546-005
Phillips-head screw M4 X 20 with thread lock	Battery housing	4	2000546-006
Phillips-head screw #4 X 0.31	■ Battery doors (2)	7	2000905-001

8 Disassembly

Service Requirements

Follow the service requirements listed below.

- Refer equipment servicing to GE authorized service personnel only.
- Any unauthorized attempt to repair equipment under warranty voids that warranty.
- It is the user's responsibility to report the need for service to GE or to one of their authorized agents.
- Failure on the part of the responsible individual, hospital, or institution using this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.
- Regular maintenance, irrespective of usage, is essential to ensure that the equipment will always be functional when required.

Disassembly/Assembly

Guidelines

WARNINGS

REPAIR TO THE FRU LEVEL — Field repairs are recommended to the field replaceable unit (FRU) only. Attempting a field repair on a PCB or a factory sealed component or assembly could jeopardize the safe and effective operation of the device.

NOTE

GE recommends that you assemble the devices using the NEW screws with a thread lock coating provided in the hardware kit. Screws with thread lock coating, are NOT intended to be re-used more than four times.

NOTE

Screw part numbers are given in the FRU assembly procedures in case of damage or loss. If a replacement screw is needed, use the part numbers to locate the correct screw in the hardware kit.

Required Tools

A standard set of hand tools is required for disassembly and assembly.

Before Disassembly

Before you disassemble any devices, ALWAYS do the following tasks.

1. Power down and unplug the device from the AC power source.
2. Remove any batteries.

3. Provide appropriate electrostatic discharge protection to prevent damaging the device. (See ESD precautions in this section.)
4. Be aware that the nonspecific disassembly instructions apply to all devices supported by this service manual. Disassembly for specific models of the device are identified when required.

During Disassembly

When disassembling the device, note the positions of wires, cables, and different sized screws; marking them if necessary to ensure they are replaced correctly.

Electrostatic Discharge (ESD) Precautions

All external connector inputs and outputs of the device are designed with protection from ESD damage. However, if the device requires service, exposed components and assemblies contained within are susceptible to ESD damage. This includes human hands, non-ESD protected work stations and/or improperly grounded test equipment.

The following guidelines help make a service workstation more resistant to the ESD damage:

- Discharge any static charge you may have built up before handling semiconductors or assemblies containing semiconductors.
- A grounded, antistatic wristband (3M part number 2046 or equivalent) or heel strap should be worn AT ALL TIMES while handling or repairing assemblies containing semiconductors.
- Use properly grounded soldering and test equipment.
- Use a static-free work surface (3M part number 8210 or equivalent) while handling or working on assemblies containing semiconductors.
- DO NOT remove semiconductors or assemblies containing semiconductors from antistatic containers (Velo-stat bags) until absolutely necessary.
- Make sure power to an assembly is turned off before removing or inserting a semiconductor.
- DO NOT slide semiconductors or electrical/electronic assemblies across any surface.
- DO NOT touch semiconductor leads unless absolutely necessary.
- Semiconductors and electrical/electronic assemblies should be stored only in antistatic bags or boxes.
- Handle all PCB assemblies by their edges.
- These guidelines may not guaranty a 100% static-free workstation, but can greatly reduce the potential for failure of any electrical/ electronic assemblies being serviced.

Back Plastic Replacement

The back plastic consists of the back plastic case of the monitor, the battery housing and battery harness.

Back Plastic Disassembly

CAUTION
EQUIPMENT DAMAGE — The display assembly components are NOT secured once you remove the shipping bracket. ALWAYS keep the display on a flat work surface with the **TRIM KNOB** control hanging over the edge.

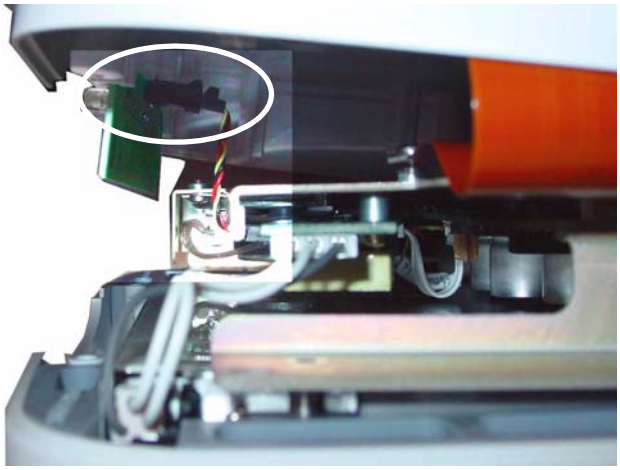
The back plastic is not a FRU. However, most FRU disassembly/assembly instructions require you to remove the back plastic.

To remove the back plastic, follow this procedure.

1. Unplug the monitor from the AC power source.
2. Remove both batteries from the monitor.
3. Remove the TRAM module from the TRAM chute.
4. Remove the TRAM chute.
5. Remove the six screws from the back of the monitor.

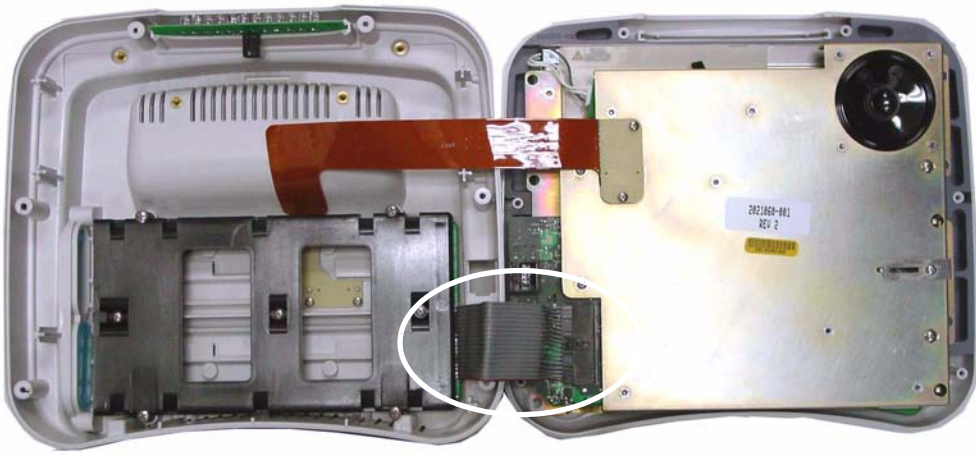
603A

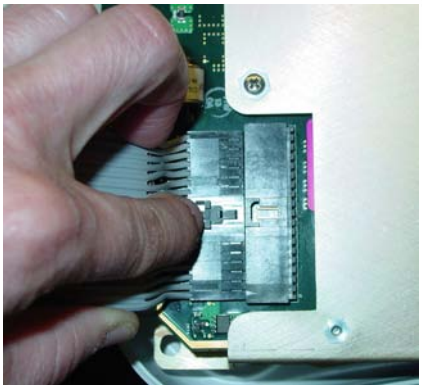
6. Remove the alarm light cover.
7. Disconnect the alarm light cable harness from the alarm light PCB.



625A

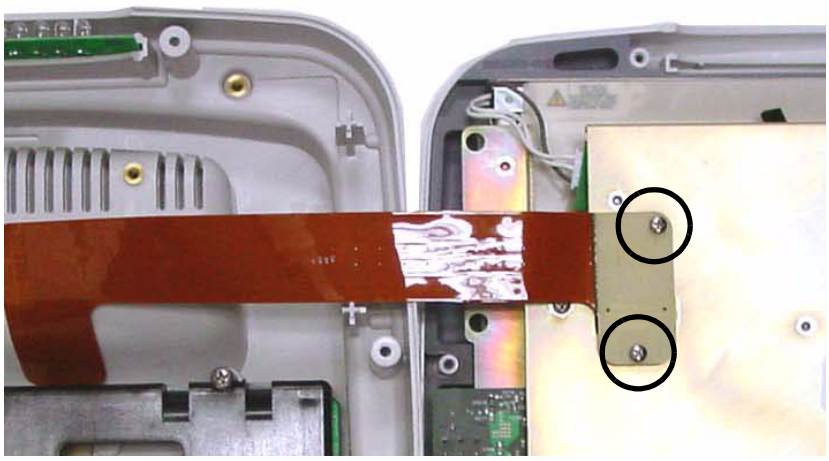
8. Lay both halves of the monitor on a flat work surface and hang the **TRIM KNOB** control over the edge of the work surface.
9. Disconnect the battery harness from the main processor PCB.





626A, 627A

10. Remove the two screws to disconnect the flex circuit cable from the main processor PCB shield.



628A

Back Plastic Assembly

To assemble the back plastic, follow this procedure.

1. Reconnect the flex circuit cable to the main processor PCB shield with the two screws (PN 402440-002).
2. Reconnect the battery harness to the main processor PCB.
3. Reconnect the alarm light cable harness to the alarm light PCB.
4. Reposition the alarm light cover.
5. Secure the back plastic to the front plastic with the six screws (PN 402440-002).
6. Attach the TRAM chute to the foot with the screw (PN 2000546-005).
7. Insert the TRAM module into the TRAM chute.
8. Insert the batteries in the monitor.

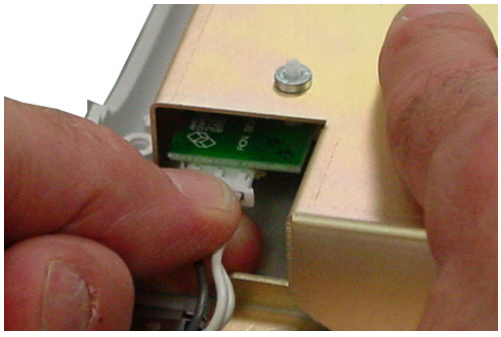
FRU Replacement

Display Subassembly

1. Remove the back plastic. See “Back Plastic Replacement” on page 8-4.
2. Remove the display subassembly.
   a. Remove the four screws holding the main processor PCB to the display assembly.

629A

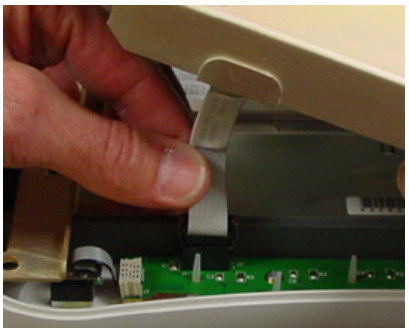
   b. Pull out the backlight friction connector from the inverter PCB. Do not pull on the connector wires.



630A

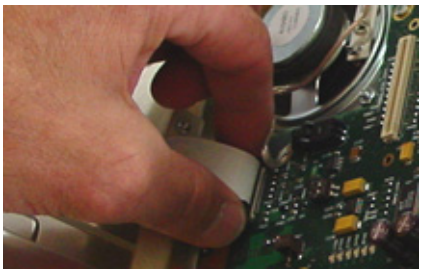
   c. Squeeze the connector tabs and pull out the connector from the

keypad PCB.



631A

d. Pull out the display friction connector from the main processor PCB. Do not pull on the ribbon cable.



632A

e. Remove the main processor PCB and set it aside.

f. Place the new display face-down with the **TRIM KNOB** control hanging over the edge of the work surface.

3. Remove the two screws from the shipping bracket on the new display. Discard the bracket and screws.
4. Reinstall the main processor PCB. Be sure to reconnect the backlight friction, keypad PCB and display friction connectors to the main processor PCB.
5. Secure the main processor PCB to the display assembly with the four screws (PN 2000540-007).
6. Assemble the back plastic. See “Back Plastic Assembly” on page 8-6.

Main Processor PCB Subassembly

1. Remove the back plastic. See “Back Plastic Disassembly” on page 8-4.
2. Remove the seven screws from the battery housing located in the back half of the monitor.

636A

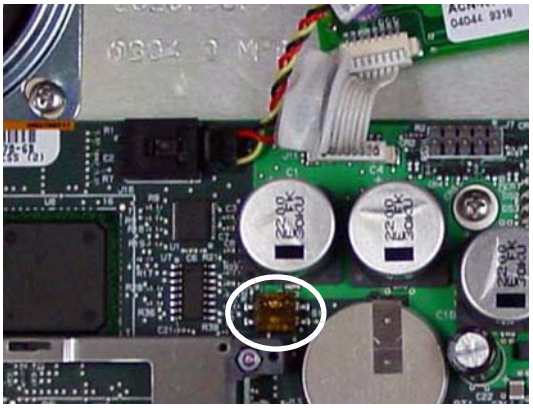
3. Remove the battery harness from the back half of the monitor.

637A

4. Remove the display subassembly. See “Display Subassembly” on page 8-7.
5. Remove the main processor PCB subassembly. Follow your country requirements for PCB disposal.

6. Turn on the main processor PCB battery switch on the new processor PCB sub-assembly.

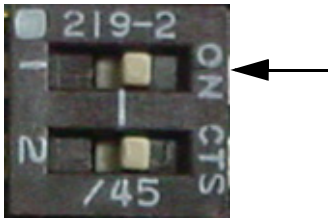
   a. Locate the mini-dip switch (labeled **S1**).



638A

   b. If a plastic film is over the switch, remove and discard the plastic film.

   c. Use a small, flat-head screwdriver to move the switch to the **ON** position, as shown below.



639A

7. Install the new main processor PCB subassembly.
8. Reinstall the main processor PCB. Be sure to reconnect the backlight friction, keypad PCB and display friction connectors to the main processor PCB.
9. Secure the main processor PCB to the display assembly with the four screws (PN 2000540-007).
10. Reconnect the battery harness to the display subassembly.
11. Secure the battery housing to the back plastic with the seven screws (PN 409914-002 and 2000546-006).
12. Assemble the back plastic. See "Back Plastic Assembly" on page 8-6.

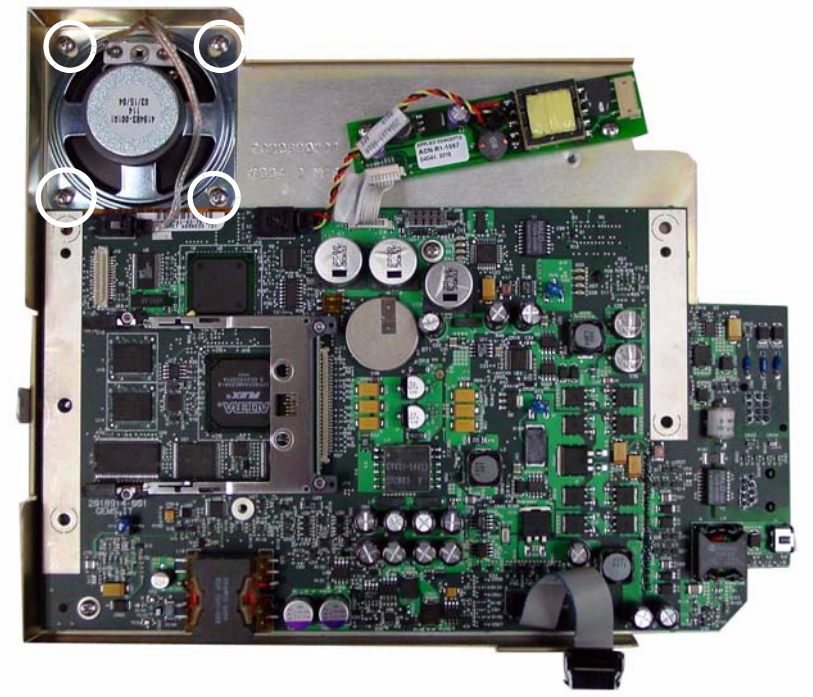
Front Plastic Subassembly

1. Remove the back plastic. See “Back Plastic Disassembly” on page 8-4.
2. Remove the main processor PCB and LCD from the front plastic.
3. Pull out the display friction connector from the main processor PCB.
4. Install the new front plastic.

5. Reinstall the main processor PCB. Be sure to reconnect the backlight friction, keypad PCB and display friction connectors to the main processor PCB.
6. Secure the main processor PCB to the display assembly with the four screws (PN 2000540-007).
7. Assemble the back plastic. See “Back Plastic Assembly” on page 8-6.

Speaker

1. Remove the back plastic. See “Back Plastic Disassembly” on page 8-4.
2. Remove the display subassembly. See “Display Subassembly” on page 8-7.
3. Remove the four screws holding the speaker onto the shield.

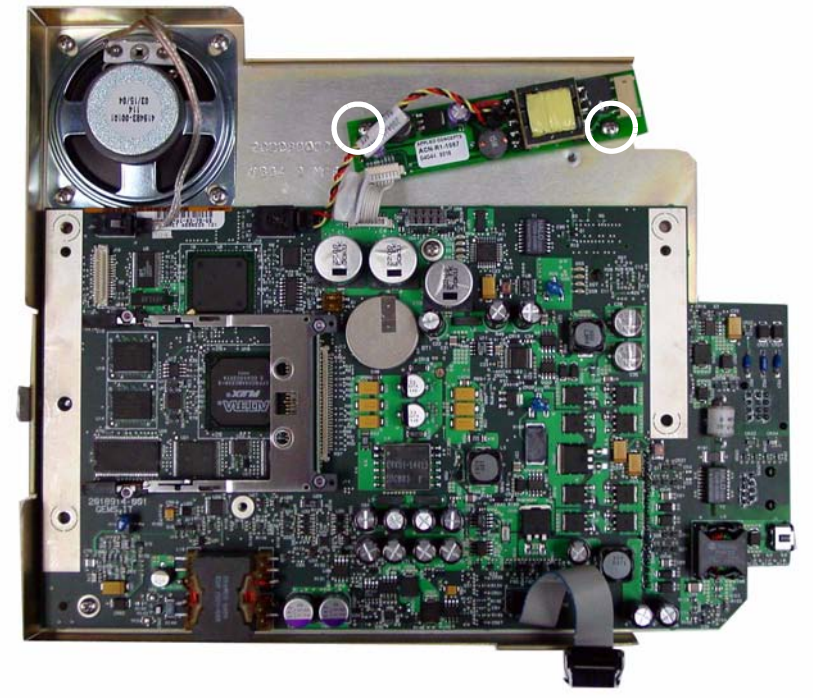


634A

4. Disconnect the speaker harness from the shield.
5. Install the new speaker.
6. Connect the speaker harness.
7. Secure the speaker to the main processor PCB with the four screws (PN 2000540-007).
8. Reinstall the main processor PCB. Be sure to reconnect the backlight friction, keypad PCB and display friction connectors to the main processor PCB.
9. Secure the main processor PCB to the display assembly with the four screws (PN 2000540-007).
10. Assemble the back plastic. See “Back Plastic Assembly” on page 8-6.

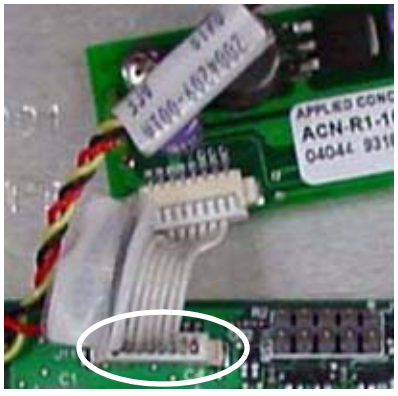
Inverter PCB

1. Remove the back plastic. See “Back Plastic Assembly” on page 8-6.
2. Remove the display subassembly. See “Display Subassembly” on page 8-7.
3. Remove the two screws holding the inverter board on the shield.



634A

4. Remove the backlight friction connector from the main processor PCB.



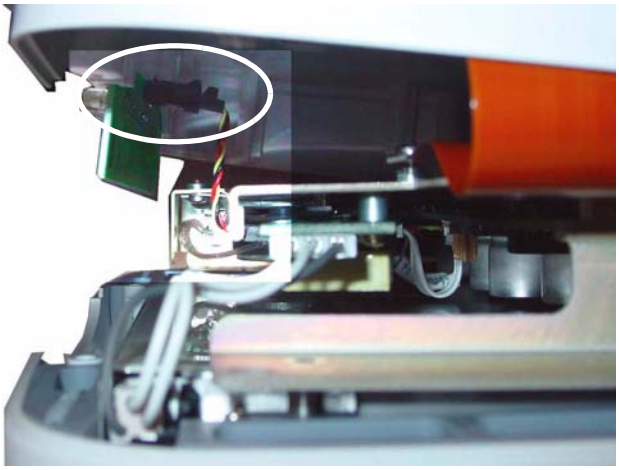
635A

5. Install the new inverter board onto the shield.
6. Connect the backlight friction connector.
7. Secure the inverter board to the main processor PCB with the two screws (PN 2000540-007).
8. Reinstall the display subassembly. Be sure to reconnect the backlight friction, keypad PCB and display friction connectors to the main processor PCB.

9. Assemble the back plastic. See “Back Plastic Assembly” on page 8-6.

Alarm Light

1. Remove the back plastic. See “Back Plastic Disassembly” on page 8-4.
2. Remove the display subassembly. See “Display Subassembly” on page 8-7.
3. Disconnect the alarm light cable harness from the alarm light PCB and the main processor PCB.

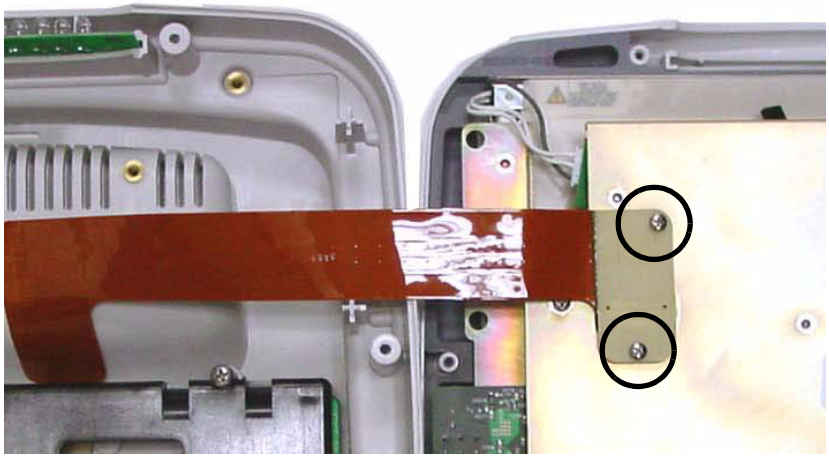


625A

4. Replace the alarm light PCB and alarm light harness.
5. Connect the alarm light cable harness to the alarm light PCB and main processor PCB.
6. Assemble the back plastic. See “Back Plastic Assembly” on page 8-6.

ePort Flex Circuit

1. Remove the back plastic. See “Back Plastic Disassembly” on page 8-4.
2. Remove the two screws that connect the flex circuit cable to the main processor PCB shield.



628A

3. Remove the battery housing. See “Main Processor PCB Subassembly” on page 8-9.
4. Remove the two screws attaching the flex circuit cable to the back plastic.
5. Replace the flex circuit.
6. Assemble the back plastic. See “Back Plastic Assembly” on page 8-6.

Foot

1. Remove the two screws that attach the foot to the back plastic.

2. Pull to slide the foot out of the grooves in the back plastic.
3. Slide the new foot into place and install the two screws (PN 2000540-001).

Battery Doors

1. Remove the battery door screws and battery doors.

604A

2. Insert battery door B into the top position
3. Insert battery door A into the bottom position.
4. Insert and tighten the two battery door screws (PN 2000905-001).

Handle

1. Remove the four screws that connect handle to the display.

603A

2. Remove the handle.
3. Align new handle and press firmly into place. You will hear a snap when in place.
4. Secure with the four screws (PN 2000543-001)

TRAM

WARNING
DROP HAZARD — Install the TRAM chute mounting screw through the display and into the TRAM chute to securely lock the TRAM chute to the display. Serious injury or death could result if this warning is not observed.

Follow these instructions to replace a TRAM chute and module with a new TRAM chute and module.

1. Remove the TRAM module.
   a. Disconnect the TRAM communication cable.
   b. Press and hold the release levers simultaneously and pull the module out about 15 cm (6 in).
   c. Once released, grasp the module firmly with both hands and remove the rest of the way. Do not try to hold the module by the release levers.
2. Remove the TRAM chute from the back of the display.
   a. Tilt the monitor back and use a Phillips-head screwdriver to remove the TRAM chute mounting screw from the foot.
   b. Slide the TRAM chute to the right to release the mounting tabs from the display.

640A

3. Align the new, empty TRAM chute with the mounting slots.

4. Slide the TRAM chute to the left to capture the mounting tabs in the mounting slots.
5. Replace the TRAM chute mounting screw (PN 2000546-005).
6. Install the TRAM module.
   a. Facing the chute, guide the back end of the module into the slot.
   b. Gently push the module into the chute. You will hear a click when the module is fully inserted.
7. Insert the TRAM communication cable into **Video In** connector on the left side of the monitor.
8. Insert the other end of the TRAM communication cable into the TRAM module's **DISPLAY** (**DISPL**) connector on the front of the TRAM module.

9 Checkout

Electrical Safety Tests

General

Electrical safety tests provide a method of determining if potential electrical health hazards to the patient or operator of the device exist.

Conditions

Perform electrical safety tests under normal ambient conditions of temperature, humidity, and pressure.

NOTE

When testing the monitor, the device under test includes the optional external power supply.

Required Equipment

The recommended test equipment required to perform electrical safety tests is listed below.

Item	Specification
Leakage current tester	Equivalent to the circuits shown
Digital multimeter (DMM)	AC V, ohms
Ground bond tester	0 – 1 ohm
External power supply	GE

Recommended Tests

WARNING

Failure to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards. Unless you have an Equipment Maintenance Contract, GE does not in any manner assume the responsibility for performing the recommended maintenance procedures. The sole responsibility rests with the individual or institution using the equipment. GE service personnel may, at their discretion, follow the procedures provided in this manual as a guide during visits to the equipment site.

GE recommends that you perform the following safety tests:

- Power outlet
- Ground (earth) integrity
- Ground (earth) wire leakage current

- Enclosure leakage current
- Patient (source) leakage current
- Patient (sink) leakage current
- Power cord and plug

Perform these tests:

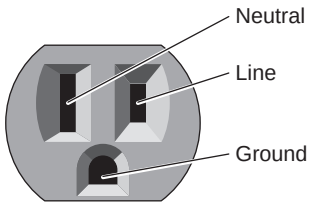
- Upon receipt of the device (monitor and all associated equipment).
- Every 12 months thereafter.
- Each time the main enclosure is disassembled or a circuit board is removed, tested, repaired, or replaced.

Record the date and results on the "For the latest PM form for this product, contact GE Service." on page 9-14

Power Outlet

Before starting the tests, the power outlet from which the monitoring device will get electrical power must be checked. This test checks the condition of the power outlet to ensure correct results from leakage tests.

A standard wall receptacle consists of three connections: line, neutral and ground. The figure below indicates the location of each on a 120 V AC wall receptacle commonly used in the United States. The location and shape of pins may be different on wall receptacles used in countries other than the United States.



001A

For international power outlets, refer to the internal standards agencies of that particular country.

If other than normal polarity and ground is indicated, corrective action must be taken before proceeding. The results of the following tests will be meaningless unless a properly wired power outlet is used.

Use this procedure to confirm AC power from the power outlet:

1. Use a DMM to measure the voltage between the three connections.
   a. Select the AC voltage scale on the DMM.
   b. Measure the voltage from line to neutral, line to ground, and neutral to ground and make sure these are correct. With a correctly wired wall receptacle used in the United States, the following readings should be obtained:

      Line to neutral: 120 V AC

      Line to ground: 120 V AC

      Neutral to ground: < 3 V AC

Readings other than these indicate improper wiring. Have the wall receptacle checked by an electrician.

2. Use a DMM to measure the ground-to-neutral loop resistance.

CAUTION
DO NOT check the ground-neutral loop resistance unless the wall receptacle is correctly wired.

   a. Select the milliohms (mΩ) scale on the DMM.

   b. Measure resistance across the power cord ground and neutral.

   c. Measure from the ground lug on the rear power connector to any exposed metal of the monitor. The resistance between the ground and neutral connections, after the ohmmeter is nulled, must be less than 100 mΩ. If not, have the wall receptacle checked by an electrician.

Ground (Earth) Integrity

Listed below are two methods for checking the ground (earth) integrity, "Ground Continuity" and "Impedance of Protective Earth Connection." These tests determine whether the device's exposed metal and power inlet's earth (ground) connection has a power ground fault condition.

Perform the test method below that is required by your Country/Local governing safety organization.

NOTE
When testing the monitor, the device under test includes the optional external power supply.

Ground Continuity

1. Disconnect the device under test from the power outlet.
2. Connect the negative (-) lead of the DMM to the protective earth terminal (ground pin in power inlet connector) or the protective earth pin in the Mains plug (ground pin in power cord). Refer to the US 120 V AC power cord figure above.
3. Set the DMM to the milliohm (mΩ) range.
4. Connect the positive (+) lead of the DMM to the equipotential stud. Resistance must read:
   - 0.1 ohm or less without power cord
   - 0.2 ohms or less with power cord

Impedance of Protective Earth Connection

This test unlike a ground continuity test will also stress the ground system by using special ground bond testers.

This test normally is only required as a manufacturing production test to receive safety agency compliance (i.e. EN 60601-1).

Some country agency's do require this test after field equipment repairs (i.e. Germany's DIN VDE 0751 standards).

Consult your country/local safety agency if in question.

Compliance is checked by following this procedure:

1. A current not less than 10A and not exceeding 25A from a current source with a frequency of 50 or 60 Hz with a no-load voltage not exceeding 6 V is passed for at least 5 s through the protective earth terminal or the protective earth pin in the mains plug and the equipotential stud which could become live in case of failure in basic insulation.
2. The voltage drop between the parts described is measured and the impedance determined from the current and voltage drop. It shall not exceed the values indicated.

For equipment without a power supply cord the impedance between the protective earth terminal and the ground tabs of the Video In connector which is protectively earthed shall not exceed 0.1 ohms

For equipment with a power supply cord the impedance between the protective earth pin in the mains plug and the ground tabs of the Video In connector which is protectively earthed shall not exceed 0.2 ohms.

When taking this measurement, move the monitor's power cord around. There should be no fluctuations in resistance.

Ground (Earth) Wire Leakage Current

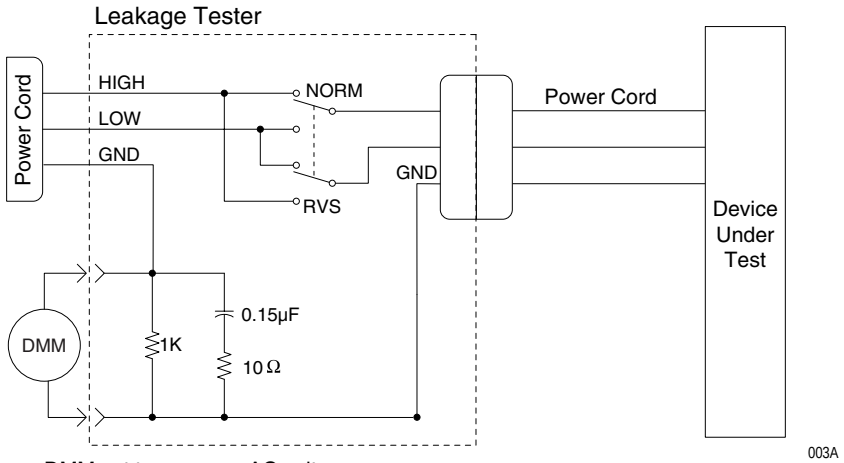
Perform this test to measure current leakage through the ground (earth) wire of the equipment during normal operation.

NOTE

When testing the monitor, the device under test includes the optional external power supply.

The device under test is to be tested at its normal operating voltage.

1. Configure the leakage tester like the circuit shown below.



DMM set to measure AC voltage

2. Connect the power cord of the device under test to the power receptacle on the leakage tester.
3. Set the power switch of the device under test to ON.
4. Read the current leakage indicated on DMM.
5. Set the polarity switch on the leakage tester to RVS (reverse).
6. Read the current leakage indicated on DMM.

NOTE

If either reading is greater than the appropriate specification below or the device under test fails, contact GE Technical Support.

- 300 µA (0.3 volts on the DMM), and the device under test is powered from 100-120 V/50-60 Hz
- 300 µA (0.3 volts on the DMM), and the device under test is powered from a centered-tapped 200-240 V/50-60 Hz, single phase circuit
- 500 µA (0.5 volts on the DMM), and the device under test is powered from a non-center-tapped, 200-240 V/50-60 Hz, single-phase circuit

NOTE

Center-tapped and non-center-tapped supply circuits produce different leakage currents and the UL and EN limits are different.

7. Set the power switch of the device under test to OFF.

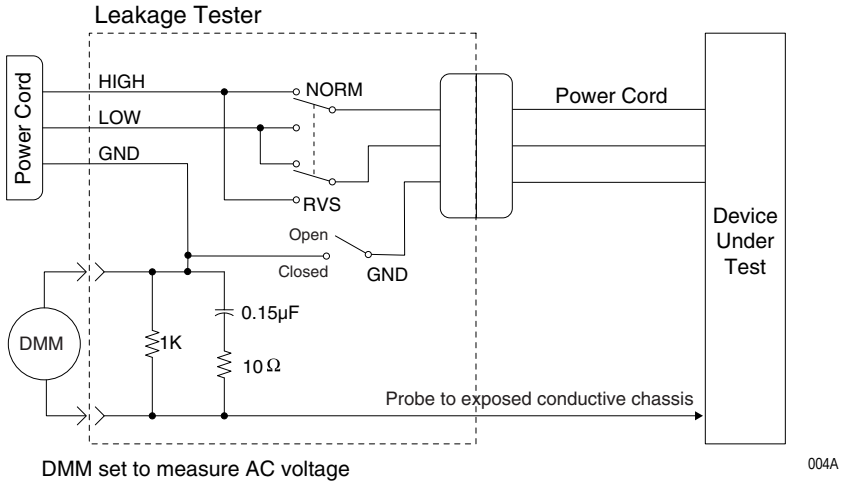
Enclosure Leakage Current

Perform this test to measure current leakage through the ground tabs on the Video In connector on the device under test during normal operation.

NOTE

When testing the monitor, the device under test includes the optional external power supply.

1. Configure the leakage tester like the circuit shown below with GND switch OPEN and polarity switch NORM.



2. Connect probe to the ground tabs on the Video In connector.
3. Set the power switch of the device to ON.
4. Read the current leakage indicated on DMM.

NOTE

Center-tapped and non-center-tapped supply circuits produce different leakage currents and the UL and EN limits are different.

5. Set the polarity switch to RVS.
6. Read the current leakage indicated on DMM.

NOTE

If either reading is greater than the appropriate specification below or the device under test fails, contact GE Technical Support.

- 300 µA (0.3 volts on the DMM), and the device under test is powered from 100-120 V/50-60 Hz
- 300 µA (0.3 volts on the DMM), and the device under test is powered from a centered-tapped 200-240 V/50-60 Hz, single phase circuit
- 500 µA (0.5 volts on the DMM), and the device under test is powered from a non-center-tapped, 200-240 V/50-60 Hz, single-phase circuit.

7. Set the GND switch on the leakage tester to CLOSED.
8. Read the current leakage indicated on DMM.
9. Set the polarity switch to RVS.
10. Read the current leakage indicated on DMM.

NOTE

If the reading is greater than the specification below, and the device under test is powered from 100-240 V/50-60 Hz, the device under test fails. Contact GE Technical Support.

- ◆ 100 µA (0.1 volts on the DMM), and the device under test is

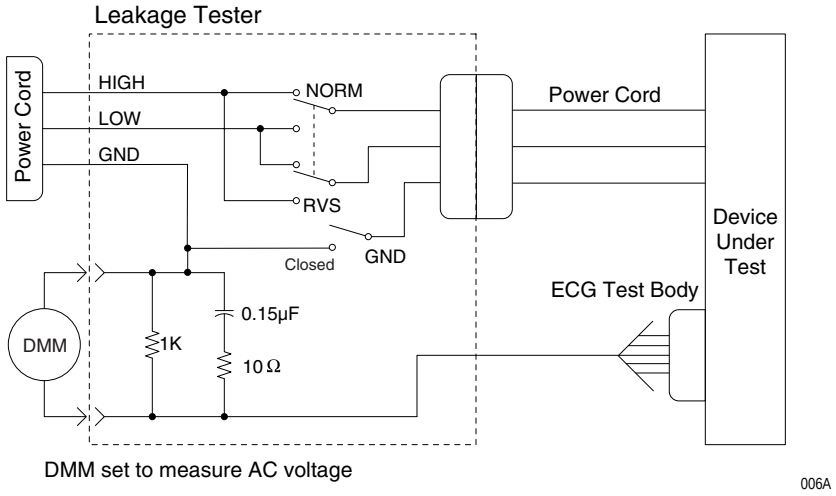
powered from 100-240 V/50-60 Hz

11. Set the power switch of the device under test to OFF.

Patient (Source) Leakage Current

This procedure only applies to Class I (grounded/earthed) equipment, and measures the leakage current from the ECG/RESP connector of the device to ground.

1. Configure the leakage tester like the circuit shown below with GND switch OPEN and polarity switch NORM.



2. Connect an ECG test body to the ECG/RESP connector of the device under test.
3. Set the power switch of the device to ON.
4. Read the leakage current indicated on the DMM.
5. Change the leakage tester polarity switch to the RVS position.
6. Read the leakage current indicated on the DMM.

NOTE

If either reading is greater than 50 µA (0.05 volts on the DMM), the device fails this test. Contact GE Technical Support.

7. Change the GND switch to the Closed position.
8. Read the leakage current indicated on the DMM.
9. Change the leakage current switch to the RVS position.
10. Read the leakage current indicated on the DMM.

NOTE

If either reading is greater than 10 µA (0.01 volts on the DMM), the device fails this test. Contact GE Technical Support.

11. Set the power switch of the device to OFF.

NOTE

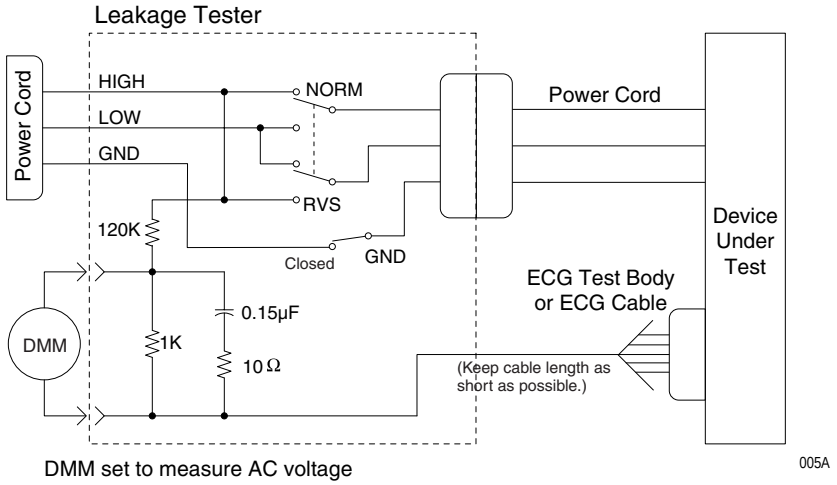
The AAMI and EN single fault condition (ground open) is 50 µA,

whereas the normal condition (ground closed) is less.

Patient (Sink) Leakage Current

This procedure only applies to Class I (grounded/earthed) equipment, and measures the leakage current from a mains voltage source into the ECG/RESP connector.

1. Configure the leakage tester like the circuit shown below with GND switch CLOSED and polarity switch NORM.



DMM set to measure AC voltage

WARNING
Shock hazard. The following step causes high voltage at the test body. Do not touch the test body.

2. Set power switch on the device to ON.
3. Read leakage current indicated on DMM.
4. Change the leakage tester polarity switch to the RVS position.
5. Read the leakage current indicated on the DMM.

NOTE
If either reading is greater than the appropriate specification below, the device under test fails. Contact GE Technical Support.

- 10 µA (0.01 volts on the DMM) at 120 V AC using the test body.
- 20 µA (0.02 volts on the DMM) at 240 V AC using the test body.
- 50 µA (0.05 volts on the DMM) at 120-240 V AC using the ECG cable.

NOTE
The 10 and 20 µA limits are based on internal design standards. The 50 µA limit is common to all standards. AAMI ES-1 standard requires using the patient cable.

6. Set the power switch on the device to OFF.

7. Disconnect the leakage tester from the wall receptacle.
8. Disconnect all test equipment from the device.
9. Disconnect the device power cord plug from the leakage tester power receptacle.

Power Cord and Plug

Verify the power cord being used with the monitor is good. The following are a couple of things to check for in this regard:

- Failure of the power cord strain relief is very common. Often times users of the equipment pull on the power cord itself, rather than the power cord plug, to unplug the monitor from a wall receptacle. If in doubt, test for continuity through each conductor of the power cord connector and plug.
- Verify line, neutral, and ground conductors are properly connected to the power cord plug and are not short-circuited. Rewire and tighten these, or replace the power cord, as necessary.

Recommended Tests and Checkout Procedures

After re-assembling the monitor, ALWAYS complete the checkout procedures, electrical safety tests, and regular maintenance procedures identified and described in this manual.

Recommended Electrical Safety Tests and Checkout Procedures		
Replacement or Upgrade	**Checkout Procedures**	**Electrical Safety Tests**
Display Front plastic Main processor PCB	1. "Power Test" on page 9-11. 2. "Battery Function Test" on page 9-12. 3. "Video Test Screens" on page 9-13. 4. "Brightness Level Test" on page 9-13. 5. "Speaker Test" on page 9-13. 6. "TRAM Communication Test" on page 9-13.	1. "Ground (Earth) Integrity" on page 9-4. 2. "Ground (Earth) Wire Leakage Current" on page 9-5. 3. "Enclosure Leakage Current" on page 9-6.
Inverter PCB and harness	1. "Power Test" on page 9-11. 2. "Video Test Screens" on page 9-13. 3. "Brightness Level Test" on page 9-13. 4. "Speaker Test" on page 9-13.	
Alarm light, lens, harness and speaker	1. "Power Test" on page 9-11. 2. "Speaker Test" on page 9-13. 3. "TRAM Communication Test" on page 9-13.	
Flex circuit	1. "Power Test" on page 9-11. 2. "Battery Function Test" on page 9-12. 3. "TRAM Communication Test" on page 9-13.	
TRAM	"TRAM Communication Test" on page 9-13.	

Recommended Electrical Safety Tests and Checkout Procedures		
Replacement or Upgrade	Checkout Procedures	Electrical Safety Tests
Foot and battery door	None	None
Handle		

Required Tools/Equipment

See the chart below for the equipment necessary to perform this checkout procedure. Equivalent equipment may be substituted.

Item	Manufacturer/Model
TRAM 100-851N module	GE
Multifunctional Micro-simulator	MARQ-III
Oscilloscope	Tektronix 2215
External power supply	GE
Known good battery	GE
TRAM communication cable	GE
Standard category 5 cross-over cable	GE

Power Test

All control panel indicators will illuminate until the power-up sequence is complete. After approximately 10 seconds you should see a display.

1. Remove all batteries and unplug the monitor from the AC power source to turn the monitor off.
2. Restore the batteries to the monitor and plug the monitor into the AC power source to turn the monitor on.
3. Verify the monitor turns on and verify the DC power indicator is illuminated.
4. Verify all of the control panel indicators illuminate on power up.
5. Verify the DC power indicator on the monitor stays illuminated.

   NOTE
   If the DC power indicator stays on, but the display is blank, the monitor is likely in “standby mode” (battery charging). Press and hold the **Power** button for approximately 0.25 seconds to enter the normal mode.

   - If the DC power indicator is on, continue with the tests.
   - If either of the **Charging Status** indicators is yellow, wait for the batteries to fully charge and the indicators to illuminate

green. The batteries may require up to four hours to charge.

- If the battery "fuel gauge" displays the word "ERROR," the battery may be asleep.

6. Verify an audio "Beep" tone sounds at the end of Boot up.
7. Verify the operation of the **TRIM KNOB** control.
   a. Rotate the **TRIM KNOB** control to scroll through several menus.
   b. Press the **TRIM KNOB** control on a menu option to verify the menu is selectable.
8. Verify the operation of the control keys.
   - Verify that an audio "Beep" tone sounds after each control panel key is pressed.
9. Check battery power for both batteries.
   a. Unplug the monitor from the AC power source. Verify the monitor stays on.
   b. Remove a battery and verify that the monitor stays on.
   c. Reinsert the battery and remove the other battery. Verify that the monitor stays on.
   d. Reinstall battery and plug the monitor into an AC power source.

Battery Function Test

The battery application software will behave differently depending on whether a acquisition device is connected. This fact also applies to which device was the "last" device that was connected. Throughout this document, when reference is made to a device being "connected", this also applies to the device being connected and then disconnected, without a different device being connected.

1. With the monitor on, disconnect the power supply from the monitor.
2. Verify the battery **Power** indicator illuminates. This indicates operation from the monitor's battery power.
3. Insert a TRAM module into the TRAM chute.
4. Connect the TRAM communication cable to the monitor and verify an ECG parameter box is displayed. This indicates the TRAM module can be run from battery power.
5. Connect the power supply to the monitor.
6. Verify the DC power indicator illuminates. This indicates the monitor is operating from the AC power source.
7. Verify the **CHARGING STATUS** indicator illuminates for a few minutes.
   - An amber glow indicates the monitor's battery is charging.
   - A green glow indicates the monitor's batteries are fully charged.

Video Test Screens

1. Access the Boot Loader program.
2. From the Service Menu, select *Video Test Screens*.
3. Select the first color test (*White Screen*), verify the display is correct and press the **TRIM KNOB** control to exit the test.
4. Repeat for each of the tests:
   - *Red Screen*
   - *Blue Screen*
   - *Green Screen*
   - *Vertical Bars*
5. Select *Exit*.
6. Reboot the monitor.

Brightness Level Test

1. Select *MORE MENUS* > *MONITOR SETUP* > *BRIGHTNESS*.
2. Verify the display brightness changes when setting the brightness level from 100% to 10%. Reset the brightness level to your default setting.

Speaker Test

1. Select *MORE MENUS* > *ALARM CONTROL* > *ALARM VOL*.
2. Change the alarm volume to 100%.
3. Verify the speaker volume changes accordingly.
4. Return the volume to the level it was previously set to, before you changed it for this test.

TRAM Communication Test

1. Confirm that all components of the monitoring system are correctly connected as described in Chapter 3, "Installation" .
2. Connect the TRAM communication cable to the TRAM module and to the monitor.
3. Turn on the monitor.
4. Verify that the **Power** indicator illuminates on the TRAM module.
5. Place the TRAM module into the chute.
6. Configure the display with as many waveforms as possible. Refer to the operator's manual, if necessary.
7. Verify that the waveforms look clean (no noise).

Completion

This completes the checkout procedure.

- Disconnect all test equipment.
- Return the monitor and acquisition device to service.
- Complete a PM Form and Repair Log.

PM Form

If repairs/adjustments were made or any parts replaced, describe this in the area provided on the PM form. Also include comments regarding any unusual environmental conditions that may affect the operation or reliability of the equipment in the area provided on the PM form.

For the latest PM form for this product, contact GE Service.

A Technical Specifications

Physical

Height	33.0 cm (13.0 in)
Width	29.3 cm (11.5 in)
Depth	14.8 cm (5.8 in) 22.1 cm (8.7 in) with TRAM
Weight (with two batteries)	3.8 kg (8.4 lbs) 7.2 kg (15.8 lbs) with TRAM

Environmental

Power requirements	battery or external DC power supply
Power consumption with TRAM	15 W 60 W
Power dissipation	120 Btu/Hour (maximum)
Cooling	passive
Atmospheric pressure	425 - 817 mmHg (56-109 kPa)
Temperature: operating storage	 10 to 40°C (50 to 104°F) -40 to 70°C (-40 to 158°F)
Relative humidity	5 to 95% at 40°C (non-condensing)
Vibration	MIL-STD 810E, Method 514.4, Category 1
Fluid ingress test	Meets EN 60601-2-27 IPX0
Drop test standard	Meets EN 60601-1 from 76.2 cm (30 inches)

Certification

UL 60601-1 classified.
UL classified for CAN/CSA C22.2 No. 601.1
EN 60601-1 certified
CE marking for Council Directive 93/42/EEC Medical Device Directive

Display

Size	10.4-inch diagonal
Type	Active-Matrix Liquid Crystal Display (LCD)
Resolution	640 by 480 pixels
Number of traces	6
Sweep speeds	6.25, 12.5, 25 mm/sec (ratio to amplitude) for BP, ECG, respiration, and SpO_2
Waveform display options	individual 6 waveforms, individual 3 waveforms, full, and full grid modes
Information window	displays non-real-time information without obstructing the display of life-critical real-time information
Display organization	prioritized by parameter

Battery

Battery type	exchangeable lithium-ion
Number of batteries	up to 2
Voltage	11.1 V nominal
Capacity	3.9 Ah
Charge time:	less than 4 hours
Run time one battery two batteries	 up to 2 hours up to 4 hours
Battery life	500 cycles to 50% capacity
Storage temperature	-20 to 60°C (-4 t0 140°F)

External Power Supply

Input	100-240 V AC, 50/60 Hz single phase
Output	16.75 VDC at 4 amps

B Electromagnetic Compatibility

Electromagnetic Compatibility (EMC)

Changes or modifications to this system not expressly approved by GE can cause EMC issues with this or other equipment. This system is designed and tested to comply with applicable regulation regarding EMC and must be installed and put into service according to the EMC information stated in this appendix.

WARNING
Use of portable phones or other radio frequency (RF) emitting equipment near the system may cause unexpected or adverse operation.

WARNING
The equipment or system should not be used adjacent to, or stacked with, other equipment. If adjacent or stacked use is necessary, the equipment or system should be tested to verify normal operation in the configuration in which it is being used.

Guidance and Manufacturer's Declaration – Electromagnetic Emissions

The Transport Pro system is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to assure that the system is used in such an environment.

Emissions Test	Compliance	Electromagnetic Environment – Guidance
RF Emissions EN 55011	Group 1	The equipment uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF Emissions EN 55011	Class A	The equipment is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic Emissions EN 61000-3-2	Class A	
Voltage Fluctuations/ Flicker Emissions EN 61000-3-3	Complies	

Guidance and Manufacturer's Declaration – Electromagnetic Immunity

The system is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to assure that the system is used in such an environment.

Immunity Test	EN 60601 Test Level	Compliance Level	Electromagnetic Environment – Guidance
Electrostatic Discharge (ESD) EN 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical Fast Transient/Burst EN 61000-4-4	± 2 kV for power supply lines ± 1 kV for input/output lines	± 2 kV for power supply lines ±1 kV for input/output lines	Mains power should be that of a typical commercial or hospital environment.
Surge EN 61000-4-5	± 1 kV differential mode ± 2 kV common mode	± 1 kV differential mode ± 2 kV common mode	Mains power should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines EN 61000-4-11	<5% U_t (>95% dip in U_t) for 0.5 cycles <40% U_t (>60% dip in U_t) for 5 cycles <70% U_t (>30% dip in U_t) for 25 cycles <5% U_t (>95% dip in U_t) for 5 s	<5% U_t (>95% dip in U_t) for 0.5 cycles <40% U_t (>60% dip in U_t) for 5 cycles <70% U_t (>30% dip in U_t) for 25 cycles <5% U_t (>95% dip in U_t) for 5 s	Mains power should be that of a typical commercial or hospital environment. If the user of the equipment requires continued operation during power mains interruptions, it is recommended that the equipment be powered from an uninterruptible power supply or a battery.
Power Frequency (50/60 Hz) Magnetic Field EN 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.

NOTE:

U_t is the AC mains voltage prior to application of the test level.

Guidance and Manufacturer's Declaration – Electromagnetic Immunity

The system is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to assure that the system is used in such an environment.

Immunity Test	EN 60601 Test Level	Compliance Level	Electromagnetic Environment – Guidance
			Portable and mobile RF communications equipment should not be used closer to any part of the equipment, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance
Conducted RF EN 61000-4-6	3 Vrms 150 KHz to 80 MHz	3 V rms	$d = 1.2\sqrt{P}$
Radiated RF EN 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 1.2\sqrt{P}$ 80 MHz to 800 MHz $d = 2.3\sqrt{P}$ 800 MHz to 2.5 GHz where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer, and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey[a], should be less than the compliance level in each frequency range[b]. Interference may occur in the vicinity of equipment marked with the following symbol:

Note 1: At 80 MHz and 800 MHz, the higher frequency range applies.

Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by reflection from structures, objects, and people.

[a] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radio, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the equipment is used exceeds the applicable RF compliance level above, the equipment should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the equipment.

[b] Over the frequency range 150 KHz to 80 MHz, field strengths should be less than 3 V/m.

Recommended Separation Distances

The table below provides the recommended separation distances (in meters) between portable and mobile RF communications equipment and the system.

The system is intended for use in the electromagnetic environment on which radiated RF disturbances are controlled. The customer or the user of the system can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the system as recommended below, according to the maximum output power of the communications equipment.

	Separation Distance in Meters (m) According to Frequency of Transmitter		
Rated Maximum Output Power of Transmitter in Watts	150 kHz to 80 MHz [a] $d = 1.2\sqrt{P}$	80 MHz to 800 MHz [a] $d = 1.2\sqrt{P}$	800 MHz to 2.5 GHz [a] $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

[a] At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

For transmitters rated at a maximum output power not listed above, the recommended separation distance [d] in meters (m) can be estimated using the equitation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE:

These guidelines may not apply in all instances. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

Compliant Cables and Accessories

WARNING
The use of accessories, transducers and cables other than those specified may result in increased emissions or decreased immunity performance of the equipment or system.

The tables below list cables, transducers, and other applicable accessories with which GE claims EMC compliance. Any supplied accessories that do not affect EMC compliance are not included.

Part No	Description	Maximum Lengths
ECG Cables		
416035-00X	Multi-Link 12-Ld ECG Standard Cable	3.6 m / 12 ft
412931-00X	Multi-Link 5-Ld ECG Standard Cable	6.0 m / 20 ft
412944-00X	Multi-Link 3-Ld ECG Neonatal Cable	3.6 m / 12 ft
2001292-00X	Multi-Link 3-Ld ECG Cable w/Grabber	3.6 m / 12 ft
411910-00X	Multi-Link 5-Ld ECG ESU	3.6 m / 12 ft
2017003-00X	Multi-Link, 3/5-Ld ECG Cable	3.6 m / 12 ft
2017004-00X	Multi-Link 3-Ld Neonatal ECG Cable	3.6 m / 12 ft
2021141-00X	Multi-Link 3-Ld ECG Cable w/Grabber	3.6 m / 12 ft
2017005-00X	Multi-Link 6-Ld ECG Cable	3.6 m / 12 ft
2017006-00X	Multi-Link 10-Ld ECG Cable	3.6 m / 12 ft
2017007-001	Multi-Link 3/5/6 Adapter	N/A
M1020453 / M1020454	Multi-Link to 300 Series 3-Ld Trunk Cable	3.0 m / 10 ft
M1020541 / M1020546	Multi-Link to 300 Series 5-Ld Trunk Cable	3.0 m / 10 ft
ECG Multi-Link Lead Wires		
412681-00X	Multi-Link lead wire Set-Group, 5-Ld, Grabber	130 cm / 51 in
412682-00X	Multi-Link lead wire Set-Group, 3-Ld, Grabber	130 cm / 51 in
414556-00X	Multi-Link lead wire set, 5-Ld, Grabber	130 cm / 51 in
41646X-00X	Multi-Link lead wire set, 5-Ld, Grabber V2-V6	130 cm / 51 in
2014811-001	Multi-Link lead wire set, 3-Ld, MiniGrab AHA Ld I	74 cm / 29 in
2014813-001	Multi-Link lead wire set, 3-Ld, MiniGrab IEC Ld I	74 cm / 29 in
2014816-001	Multi-Link lead wire set, 3-Ld, Adult Graber AHA LD II	74 cm / 29 in
2014817-001	Multi-Link lead wire set, 3-Ld, Adult Grabber IEC LD II	74 cm / 29 in

Part No	Description	Maximum Lengths
411202-00X	Multi-Link Ldwr Set-Group, 5-Ld, Snap	130 cm / 51 in
411203-00X	Multi-Link Ldwr Set-Group, 3-Ld, Snap	130 cm / 51 in
900716-001	Multi-Link Ldwr Set, Mini-Clip/DIN, Neonatal	60 cm / 24 in
411200-00X	Multi-Link Ldwr Set, 5-Ld, Snap	130 cm / 51 in
403751-0XX	Multi-Link Ldwr Set, Radiotranslucent Grabber	1.6 m / 60 in
42193X-00X	Multi-Link Ldwr Set, 6-Ld, Snap	130 cm / 51 in
412680-00X	Multi-Link Ldwr Set, Individual, Grabber	130 cm / 51 in
412596-00X	Multi-Link Ldwr Set, Individual, Snap	130 cm / 51 in
416447-0XX	Multi-Link Ldwr Set, Individual, Grabber, V2-V6	130 cm / 51 in
545315 / 545317	300-Series 3-Ld Set w/clips	75 cm / 30 in
8001958 / 8001960	300-Series 3-Ld Set w/clips	1.5 m / 60 in
545327	300-Series 3-Ld Set w/snaps	75 cm / 30 in
545316 / 535318	300-Series 5-Ld Set w/clips	125 cm / 49 in
8001959 / 8001961	300-Series 5-Ld Set w/clips	1.5 m / 60 in
545328	300-Series 5-Ld Set w/snaps	125 cm / 49 in
54534X	300-Series replacement clip lead	125 cm / 49 in
800327X	300-Series replacement clip lead	1.5 m / 60 in
545358 / 545359	300-Series replacement clip lead	75 cm / 30 in
54535X	300-Series replacement snap lead	125 cm / 49 in
Invasive BP Cables and Tranducers		
700078-001	Utah Transducer Adapter Cable	3.6 m / 12 ft
700077-001	Spectramed Transducer Adapter Cable	3.6 m / 12 ft
2005772-001	Dual BP adapter	30 cm / 12 in
2016997-00X	Utah Transducer Adapter Cable	3.6 m / 12 ft
2021196-00X	Abbott Transpac-IV Adapter Cable	3.6 m / 12 ft
2021197-00X	Edwards Truwave Adapter Cable	3.6 m / 12 ft
2016995-00X	Spectramed Transducer Adapter Cable	3.6 m / 12 ft
N/A	Utah Disposable Transducers (DPT, DP2, DP3)	N/A
N/A	Spectramed Transducers (TC-MQ)	N/A
N/A	Abbott Transpac-IV Transducers	N/A
N/A	Edwards Truwave Transducers (PX)	N/A

Part No	Description	Maximum Lengths
Temperature Cables and Probe		
402015-004	Dual Temp Cable	20 cm / 8 in
9445-XXX	Temp Probe interconnect Cable	3.6 m / 12 ft
2016998-001	Dual Temp Cable	20 cm / 8 in
Pulse Oximetry Cables and Sensors		
2006644-001	Nellcor RCAL Interface Cable	3.6 m / 12 ft
2002592-00X	Masimo Set Interface Cable	3.6 m / 12 ft
2017002-00X	Masimo Set Interface Cable	3.6 m / 12 ft
2002799-001	Masimo Finger Sensor, Pediatric	N/A
2002800-001	Masimo Finger Sensor, Adult	N/A
407705-00X	Nellcor Sensor Finger Probe	N/A
Accessories		
2006171-00X	TRAM Module Series	N/A
403496-001	TRAM Communication Cable	4.5 m / 15 ft
N/A	RJ45 series Category 5 cable	N/A
2017857-002	Battery Lithium-Ion	N/A
2012183-001	DC Power Supply	N/A
2000633-001	Defib Sync Cable	3.0 m / 10 ft

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